

This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



C
160 e 370.

THE PRACTICE

OF

SURGERY







PLATE I









FRONTISPIECE.

DESCRIPTION OF PLATE I.

FIG. 1.—Hunterian Chancre.

Vide page 137.

FIG. 2.—Epithelial Cancer attacking a scar.

Vide page 176.

FIG. 3.—Charbon.

Vide page 134.

FIG. 14.—Cystic degeneration of a Nævus.

Vide page 526.





A MANUAL

FOR THE

PRACTICE

OF

SURGERY

BY

THOMAS BRYANT, F.R.C.S.

MEMBER OF THE COUNCIL AND COURT OF EXAMINERS OF THE ROYAL COLLEGE OF SURGEONS;
SENIOR SURGEON TO, AND LECTURER ON SURGERY AT, GUY'S HOSPITAL;
MEMB. CORRESPOND. DE LA SOCIÉTÉ DE CHIRURGIE DE PARIS

WITH SEVEN HUNDRED AND FORTY-SEVEN ILLUSTRATIONS

Fourth Edition (Twelfth Thousand)

VOL. I

LONDON
J. & A. CHURCHILL
11, NEW BURLINGTON STREET
1884

BODLEIAN LIBRARY
13 DEC 84
OXFORD.

PREFACE TO FOURTH EDITION.

In preparing a Fourth Edition of this work, no pains have been spared to justify the kind support which the Profession has accorded to its predecessors.

Every chapter has been carefully revised, and to each much new material has been added.

Chapter I, on Wounds and Inflammation; Chapter III, on Tumours; Sections on the Diseases of the Tongue, Operations on the Kidney, Lithotrity, the Removal of Tumours from the Bladder, Injuries to the Epiphyses, Osteotomy, Bone-setting, Charcot's Disease, Ovariotomy, and Hysterectomy, have been added or rewritten; attention has been drawn to the new operation of Colectomy, and much fresh information given upon that of Colotomy.

Through the liberality of the Publishers, some excellent Chromolithographs of Diseases of the Tongue, Breast, and other affections, which could not well be illustrated without colour, have been introduced, the drawings having been copied from those in my possession or in the Guy's Hospital Museum. Eighty-four new Woodcuts have likewise been added.

A full Index has been bound up with each volume to facilitate reference; and an expanded Table of Contents inserted. Upon the whole, it is hoped that the present edition will prove acceptable to those who may consult its pages.

THOMAS BRYANT.

53, Upper Brook Street,
Grosvenor Square,
London; *August*, 1884.



PREFACE TO SECOND EDITION.

A SECOND EDITION of this manual having been called for, I have availed myself of the opportunity to make some alterations in the substance as well as in the arrangement of the work, and, with a view to its improvement, have recast the materials and revised the whole. I have, also, to make the work more complete, added much new matter, including chapters on diseases and injuries of the eye and ear, some remarks on dental surgery, on the diagnosis of ovarian tumours, and on deformities, together with at least one hundred new woodcuts.

The book has also, for the sake of greater convenience, been divided into two volumes, the first including the elementary principles of our art, general subjects, tumours, the surgery of the cutaneous, lymphatic, nervous, circulatory, and digestive systems; and the second the surgery of the respiratory, urino-genital, muscular, and osseous systems; gunshot wounds and amputations, with a full general index.

I am well aware that I have failed to realise, in the execution of my task, the ideal standard, I at starting, proposed to myself, and I knew when I first undertook to write the book how difficult it was to compress the treatment of the vast range of subjects included under the title of Surgery into one volume; but my object was to offer such an epitome of the main principles and methods of practice as should be serviceable to the student and practitioner; and from the reception the first edition of this work, published in November, 1872, has met with in Great Britain and America, I feel justified in saying

that I have not failed in the attempt, and that the book supplied a want felt by the professional public.

To the many reviewers, who have acknowledged my labours so fairly and so fully, my thanks are clearly due, but still more to the profession which has welcomed my humble services so kindly.

Fully alive, therefore, to the generous appreciation of my past work, and assuring my readers that no pains have been spared to bring the present up to as high a standard as my time and opportunities have allowed, I submit it in all confidence to the kind consideration of my professional brethren as no unworthy exposition of modern British Surgery.

In its execution I have endeavoured to acknowledge on all occasions the claims of others, and whatever merit or novelty may attach to their views or operations; for my wish has been to represent not so much my own opinion as the position of Surgery at the time I write.

It only remains for me to express once more my obligations to Mr. Thomas Turner, the Treasurer of Guy's Hospital, by whose kindness the materials in the unrivalled collections of that institution were placed at my disposal; to my colleagues, Drs. Moxon, Goodhart, and Purves, Messrs. Howse, C. Higgens, and Moon; and to Mr. Wesley, the artist who has so ably illustrated these pages.

Since I first undertook this work death has deprived me of two colleagues, Mr. Poland and Dr. Phillips, both of whom rendered me many friendly services and much valuable assistance. I refer to their names with gratitude and regret.

53, Upper Brook Street,
Grosvenor Square;
March, 1876.

TABLE OF CONTENTS.

VOLUME FIRST.

INTRODUCTORY CHAPTER.

	PAGE
Skilled and unskilled observation	1
Diagnosis. By exclusion	2
How to investigate a case	3
Value of clinical history	3
Diathesis	5
Hæmophilia	6
Cachexia	6
Points for surgical inquiry in reporting	7

CHAPTER I.

WOUNDS. REPAIR AND INFLAMMATION.

Wounds, their Classification	9
Incised wounds	10
Local and constitutional effects of	11
Traumatic fever	13
Repair in wounds	14
1. *By primary adhesion or first intention and cicatrization*	15
2. *By granulation or second intention*	16
3. *By secondary adhesion or third intention*	17
4. *By scabbing*	17
Nature of healing process	17
Regeneration of tissue	18
Repair of muscle and nerve	18
Causes of non-repair	19
Local and general	20
Treatment of wounds	22
On cleansing wounds (1st indication)	22
Arrest of bleeding (2nd indication)	24
Repair by primary or secondary adhesion	24
Six cardinal points to be observed in the treatment of all wounds	25
The coaptation of edges; (3rd indication)	26
Varieties of sutures	27
Materials for	29
Value of pressure in	30
Immobility of parts (4th indication)	30
Drainage of wound (5th indication)	31
Protection of wound (6th indication)	32
On second dressing *of a closed wound*	33
Contused and lacerated wounds	35
Hæmorrhage in	36
Subcutaneous contused wounds	36
Treatment of contused wounds	37
Punctured wounds	38
Their dangers and treatment	39
Tooth wounds	40
Treatment of open wound	41
Special treatment of wounds	41
By occlusion	42
By exposure	44

CHAPTER I.—*Continued.*

	PAGE
Special treatment of wounds—	
By water dressing	47
The dry dressing of wounds	49
Earth dressings	50
Alcoholic dressings	50
Pneumatic aspiration	51
Antiseptic irrigation	52
The Listerian method	54
Subcutaneous wounds	58
Repair in	59
Treatment of	60
Wound complications	61
Consecutive and secondary hæmorrhage	63
Defects in healing process	64
From deficiency of, and over action in	65
Diseases of granulations	67
On inflammation	69
Local phenomena of	69
Effects of inflammation on the tissues	72
Abscess	74
Acute abscess—its progress.	75
Chronic abscess	75
Treatment of	76
Sinus and fistula	80
Ulcers and sores and their varieties	82
Lupus	89
Bedsores	90
Mortification or gangrene	91
Traumatic (direct and indirect)	92
Anæmic or arterial	93
Static or venous	93
Hospital	96
Erysipelas	99
Erythema	107
Septicæmia and pyæmia	108
Hectic fever	120

CHAPTER II.

ON ANIMAL POISONS.

Dissection wounds	122
Anatomical tubercle	124
Insect stings and serpent bites	124
Bites of diseased animals	127
Rabies	127
Glanders	131
Equina mitis	133
Charbon	134
Syphilis	135
Acquired	137
Hereditary	144
Vaccino-syphilis	150

CHAPTER III.

TUMOURS.

General remarks on tumours	152
Varieties	153
1. *Innocent tumours*	160
Lipomata	160
Fibromata	161
Chondromata	163
Adenomata	165
2. *Semi-malignant tumours*	167
Sarcomata	167
Myxomata	170
3. *Cancerous tumours*	171
Hard or scirrhous	173
Medullary	174
Epithelial	176
Rodent ulcer	177
Colloid	178
Villous	179
Causes of cancer	180
Treatment of	181
Granulation tumours	184
Cysts	185
Microscopical anatomy of tumour	191

CHAPTER IV.

SURGERY OF CUTANEOUS SYSTEM.

	PAGE		PAGE
Contusions	200	*Perforating ulcer of foot*	224
Arrow wounds	202	*Delhi boil*	224
Burns and scalds	203	*Mycetoma*	225
Effects of lightning	208	*Warts, moles and corns*	226-7
Cicatrices, diseases of	209	*Bunions*	228
Skin grafting	213	*Toe-nails, ingrowing of*	229
Sponge grafting	217	*Onychia maligna, &c.*	230
Chilblains	218	*Elephantiasis and elephas*	233
Frostbite	219	*Parasites*	235
Boils and carbuncle	220-1	*Guinea worm—chigoe*	236
Facial carbuncle	223	*Hydatid*	237

CHAPTER V.

SURGERY OF LYMPHATIC SYSTEM.

Wounds of lymphatics	238	*Thyroid gland, diseases of—*	
Inflammation of	238	*Cystic bronchocele*	245
Lymphadenoma	241	*Acute hypertrophy*	246
Thyroid gland, diseases of	243	*Thyroidal tumours*	247
Goitre	243	*Operation*	248

CHAPTER VI.

INJURIES OF THE HEAD.

Contusions and wounds of scalp	249	*Hernia cerebri*	275
Contusions of bones of skull	252	*Encephalitis, a result of injury*	277
Injuries of the cranium	253	*Treatment of injuries of the cranium and its contents*	280
General propositions on	253	*Trephining, its value*	283
Fractures of the vault	254	*Operation of*	285
" of vault and base	255	*General conclusions on injuries of the head and their treatment*	287
" compound	257	*Diseases of scalp and cranium*	288
Diagnosis of	257	*Tumours of skull*	289
Concussion of the brain	261	*Meningocele*	289
Extravasation of blood, a result of concussion	263	*Cysts simulating encephaloceles*	291
Remote effects of head injuries	266	*Ostitis of cranial bones*	291
Injuries of the brain and its membranes, complicating fracture	266	*Tetanus and trismus*	293
Blood between bone and dura mater	267	*Delirium tremens*	298
Compression of the brain	271	*Shock and collapse*	301
Wounds of brain	274	*Hysterical disease*	305

CHAPTER VII.

INJURIES AND DISEASES OF THE SPINE.

	PAGE
Spina bifida	307
Sacral and coccygeal tumours	311
Injuries of the spine	313
Local and diffused	313
Intra-spinal inflammation	316
Fractures and dislocations of the spine	320
Wounds of spinal cord	327
Sprains of the back	328
Curvature of the spine	329
Lateral curvature	329
Angular curvature	332
Injuries and diseases of nerves	340
Wounds of nerves	340
Neuralgia	342
Neuroma	343
Nerve-stretching	344
Painful subcutaneous tumours	345

CHAPTER VIII.

DISEASES AND INJURIES OF THE EYE.

Examination of eyeball	346
By ophthalmoscope	348
Its difficulties	351
Anomalies of optic disc	353
Refraction, accommodation	354
Diseases of	359
Diseases of eyelids	362
„ *conjunctiva*	364
Ophthalmia	365
Affections of muscles of eyeball	370
Cornea—its diseases	371
„ *ulcers of*	374
„ *wounds of*	376
Sclerotic, inflammation of	376
Injuries of	377
The lens—anomalies of	377
Dislocation of	378
Iris and choroid, anomalies of	379
„ *inflammation of*	380
Choroid, hyperæmia of	383
„ *inflammation of*	383
Sympathetic ophthalmia	385
Vitreous humour, affections of	386
Glaucoma	386
Retina and optic nerve, affections of	390
Inflammation	391
Embolism of	393
Choked disc	394
Atrophy of nerve	395
Operations on eyeball	396
„ *on eyelids*	399
„ *on lachrymal apparatus*	404
„ *on conjunctiva*	407
„ *for strabismus*	408
„ *on cornea*	413
„ *on sclerotic*	416
„ *on iris*	416
„ *on lens*	421
„ *for solution*	423
„ *for extraction*	424
„ *by suction*	429
Extirpation of eyeball	431
Affection of orbit	433
Protrusion of eyeball	433
Vascular protrusion of	436
Tumours of orbit	438
Tumours of eyeball	440
Suppuration of eyeball	442

CHAPTER IX.

AFFECTIONS OF THE EAR.

	PAGE		PAGE
Malformations of ear	443	*Inflammation of ear*	453
Injuries to external ear	445	*Polypus of*	455
Tumours of auricle	445	*Affections of membrana tympani*	455
How to examine the ear	447	„ *of middle ear*	459
Foreign bodies in ear	448	„ *of labyrinth*	464
Syringing ear	449	*Deaf-mutism*	465
Affection of the external meatus	451		

CHAPTER X.

SURGERY OF THE CIRCULATORY SYSTEM.

Wounds of the heart	466	*Transfusion*	484
„ „ *arteries*	468	*Diseases of arteries*	486
Repair of wounded arteries	469	*Embolism*	490
Natural hæmostatics	469	**Aneurism**	493
Surgical hæmostatics	471	*Its pathology*	494
Effects of ligature	472	*Its natural cure*	496
„ *of torsion*	473	*Symptoms and diagnosis of*	499
On hæmorrhage and its treatment	473	*Treatment of*	501
The use of the ligature	477	1. *By compression*	502
„ *acupressure*	478	2. *By direct pressure*	508
„ *torsion*	479	3. *By distal pressure*	509
„ *the artery constrictor*	480	4. *By ligatures*	511
The use of other methods	481	*By manipulation*	515
Summary of the treatment of hæmorrhage	482	*By galvano-puncture*	516
General treatment of hæmorrhage	483	*By other methods*	516
		Traumatic aneurism	517
		Arterio-venous	520
		Cirsoid aneurism	523
		Nævus	525

THE LIGATURE OF ARTERIES.

General observations on	529	*Palmar hæmorrhage*	547
Ligature of the aorta	532	*Ligature of external iliac artery*	547
„ „ *arteria innominata*	533	„ „ *internal iliac*	549
„ „ *common carotid*	535	„ „ *the femoral artery*	550
„ „ *external or internal carotid*	538	„ „ *the popliteal*	552
„ „ *lingual*	538	„ „ *the posterior tibial*	552
„ „ *facial*	539	„ „ *the anterior tibial*	554
„ „ *subclavian*	539	„ „ *the dorsal artery*	555
„ „ *axillary*	542		
„ „ *brachial*	544		
„ „ *radial*	545		
„ „ *ulnar*	546		

CHAPTER XI.

INJURIES AND DISEASES OF VEINS.

	PAGE		PAGE
Wounds of veins	555	*Diseases of veins*	562
Inflammation of	557	*Varicose veins*	563
Air in veins	561	*Venesection*	568

CHAPTER XII.

THE SURGERY OF THE DIGESTIVE ORGANS.

Lip, *wounds of*	570	*Tongue, suppuration of*	591
Congenital fissures of lip	570	,, *hydatid cyst in*	591
Harelip	571	,, *glossy*	592
Cancer of the lip	576	,, *ulceration of*	593
Hypertrophy of	578	,, *syphilitic disease of*	596
Cystic tumours of	579	,, *cancer of*	599
Cancrum oris	579	,, *tubercular ulceration of*	603
Ranula	581	,, *removal of*	604
Salivary calculus and fistula	582	**Palate**—*fissures of*	606
Parotiditis	583	,, *wounds of*	611
Parotid tumours	583	,, *ulceration of*	612
Tongue-*tie*	584	,, *tumours of*	612
,, *wounds of*	585	*Tonsillitis*	613
,, *congenital affections of*	585	*Chronic enlargement of tonsils*	614
,, *nævi of*	587	*Calculus in tonsil*	615
,, *ichthyosis of*	588	*Cancer of tonsil*	616

CHAPTER XIII.

DISEASES OF THE GUMS, JAWS, TEETH, PHARYNX, AND ŒSOPHAGUS.

Gums—diseases of	617	*Tumours of upper jaw—Removal of*	626
Jaws—necrosis of	617	*Tumour of lower jaw*—	627
,, *epulis*	619	*Removal of*	629
,, *tumours of*	621	*Disease of temporo-maxillary articulation*	630
Antrum, disease of	621	*Closure of jaws*	630
Dentigerous cysts	622	*Jaw, dislocation of*	631
,, *tumours*	624	*Fracture of*	633
Tumours of upper jaw	624		

DENTAL SURGERY.

	PAGE		PAGE
Tooth development	638	*Teeth, diseases of*	654
Odontomes	640	*Odontalgia or toothache*	655
Dentigerous cysts	643	*Remote nervous affections*	656
Supplemental and supernumerary teeth	644	*Dental caries*	659
Syphilitic teeth	645	*Fracture of teeth*	664
Malformed teeth	645	*Affections of the pulp*	665
Teeth, structural defect in	648	*Periodontitis*	666
,, *cutting of the*	649	*Rigg's disease*	667
,, *irregularity of*	650	*Alveolar abscess*	669
,, *absence of*	653	*Gums—affections of*	670
		Extraction of teeth	671

AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

Pharynx, inflammation of	674	*Cancer of œsophagus*	676
Dysphagia	675	*Foreign bodies in*	678
Œsophageal obstruction	676	*Œsophagotomy*	682

CHAPTER XIV.

INJURIES OF THE ABDOMEN.

Contusions of abdomen	683	*Intestinal obstruction—*	
Value of special symptoms, shock, pain, vomiting	684	*Chronic obstruction*	712
Rupture of viscera	684	*Intussusception*	716
Wounds of abdomen	695	*Laparotomy*	718
Penetrating	695	*Enterotomy*	719
With protruding viscera	696	*Colectomy*	721
Abscess and fæcal fistula	699	*Colotomy*	723
Foreign bodies in stomach and intestines	702	*Excision of pylorus*	727
Gastrotomy and gastrostomy	704	*Tapping intestine*	727
Intestinal obstruction	707	,, *abdomen*	728
Acute strangulation	709	*Hydatid tumour*	729
		Tumour of umbilicus	731

CHAPTER XV.

HERNIA.

	PAGE
Diagrams of varieties	732
Abdominal hernia	734
„ „ *anatomy of*	735
„ „ *symptoms of*	737
Hydrocele of sac	738
Hernia, irreducible	739
„ *obstructed*	740
„ *inflamed*	741
„ *rupture of*	741
„ *strangulated*	743
„ *results of strangulation*	745
Strangulated hernia and its treatment	748
The taxis	749
Herniotomy	751
Multiple herniæ	759
Displaced hernia	759
1. *Reduction* en masse	760
2. *Displaced neck of sac (Bell's form)*	760
3. *Interstitial, with ruptured sac*	762
4. *Interstitial, with herniated neck of sac*	763
Inguinal hernia	765
Its radical cure	769
Femoral hernia	773
Obturator hernia	776
Umbilical hernia	778
Ventral hernia	781
Other forms	781
Trusses	782

CHAPTER XVI.

SURGERY OF THE ANUS AND RECTUM.

	PAGE
Malformations	786
Injuries of rectum	790
Rupture of rectum	791
Foreign bodies in rectum	792
Disease of rectum, mode of examination	793
Painful ulcer of rectum	794
Anal abscess and fistula	797
Hæmorrhoids	801
Prolapsus recti	808
Polypus of rectum	810
Ulceration of rectum	812
Stricture of rectum	814
Excision of rectum	819
Atony of colon and dilatation of rectum	820
Nutrient enemata	821

VOLUME FIRST.

LIST OF ILLUSTRATIONS.

Fig.		*page*
1.	Placoid cells	14
2.	Diagram illustrating the process of repair	15
3.	Irrigating apparatus for washing wounds	23
4.	The interrupted suture	26
5.	The continued suture	27
6.	The twisted suture	28
7.	The quilled suture	28
8.	The button suture	29
8½.	Leiter's metallic coil for heat or cold	48
9.	Pus-corpuscles	73
10.	Abscess knife	76
11.	Sinus scissors	82
12, 13.	Thermographs of erysipelas	100
14.	Thermograph of pyæmia	110
15, 16.	Thermographs of traumatic fever	111
17, 18.	Ditto ditto	111
19.	Anatomical tubercle	124
20.	Bacilli from charbon	134
21.	Syphilitic deposit in testicle	140
22.	Hereditary syphilis	146
23.	Syphilitic teeth	147
24.	Healthy teeth	147
25.	Fatty tumour	160
25A.	Diffused lipoma	161
26.	Molluscum fibrosum	162
27.	Fibrous tumour	163
28.	Enchondromatous tumour	164
29.	Adenoid tumour	166
30.	Sarcoma of bone	168
31.	Melanotic sarcoma	169
32.	Epithelial cancer of stump	176
33.	Rodent cancer	178
34.	*Colloid tumour of breast, with section*	*179*
35.	Fungating follicular tumour	184
36.	Serous cyst of neck	185
37.	Sebaceous tumours and horn in scalp	189
38.	Microscopical anatomy of osteoma, enchondroma	193
39.	Ditto, adenoma	194
40.	Ditto, lymphoma	195
41.	Ditto, sarcoma	196
41B.	Ditto, myxoma	197
42.	Ditto, carcinoma	198
43.	Rib pierced by arrow	202
44A.	Axillary cicatrix after burn	209
44B.	Mode of applying extension after its division	209
45.	Effects of burn on neck	210
46A.	Cheloid of Alibert	212
46B.	Cheloid of Addison	212
47.	Congenital cicatrix of lip, nose, &c.	212
48A, 48B.	Drawings illustrating the cicatrization of sores by skin-grafting	214
49.	Scissors for skin-grafting	215
50A, 50B.	Drawings illustrating growth of black skin when grafted on sore of white man	216
51A.	Bunion	228
51B.	Toecap for cure of bunion	228
52.	Ingrown toe-nail	230
53.	Acute onychia	231
54.	Chronic onychia	231
55.	Horny growth beneath nail	232
56.	*Ungual exostosis*	232
57.	*Elephantiasis* Arabum *before operation*	234

Fig.	page
58. Elephantiasis Arabum, after operation	234
59. Guinea-worm bleb	236
60. Exophthalmic goitre	244
61. Pedunculated thyroidal tumour	247
62. Microscopical appearance of thyroid glands	247
63. Gutter-shaped fracture of skull	254
64. Saucer-shaped ditto	254
65. Comminuted fracture of skull with depression of inner table	255
66. Fracture of base of skull	256
67. Fracture of anterior fossa of the base of the skull	260
68. Punctured wound of skull	261
69. Extravasation of blood between bone and dura mater	269
69A. Section of skull with cranial contents showing ditto	269
70. Hernia cerebri	275
71. Operation of trephining with instruments for	284
72. Meningocele at root of nose	290
73. Encephalocele	290
74. Necrosis of frontal bone	292
75. Dissection of spina bifida	308
76. Double spina bifida	309
77. Cured spina bifida	310
78, 79. Congenital coccygeal tumours	312
80. Dislocation of spine forwards	321
81A. Fracture of spine	321
81B. Fracture of spine and displacement backwards	321
82, 83. Lateral curvature of spine	330
84, 84A. Angular curvature of spine	332
85, 85A, 85B. Disease of cervical vertebræ	334
86. Synostosis of ribs to vertebræ	334
87A. The rigid spine of spinal disease	335
87B. Child supporting body in spinal disease	335
88, 88A. Sayre's apparatus for spinal curvature	338
89. Liebreich's ophthalmoscope	349
90. Indirect ophthalmoscopic examination	350
91. Accommodation and refraction	355
92. Oldham's ophthalmoscope	358
93. Position of patient for minor operations	396
94. Position for major operations	396
95. Compressorium forceps	400
96. Compressorium forceps, applied	400
97. Wire speculum	403
98. Grooved director for slitting canaliculus	406
99. Instruments for operations for strabismus	411
100. Instruments for iridectomy	417
101. Wecker's scissors	420
102. Artificial pupils	420
103. Instruments for extraction of cataract	424
104. Incisions for extraction of cataract	425
105. Instruments for removal of cataract with scoop	428
106. Extirpation scissors	432
107. Occlusion of external auditory canal, with deformed auricle, and lobulus displaced on cheek	443
108. Politzer's method of examining middle ear	444
109. Effects of injury on ear	445
110. Hæmatoma auris	446
111. Cheloid tumour of ear	446
112. Microscopical appearances of same	446
113. Syringing ear	449
114. Appearance of membrana tympana	456
115. Effects of natural hæmostatics	470

Fig.	*page*
116, 117. Effects of contusion on an artery	470
118. Effects of ligature on an artery	471
119. Effects of torsion on artery	473
120. Drawing showing application of ligature to artery, tourniquet, torsion forceps, &c.	476
121. Different modes of acupressure	478
122. The femoral artery twisted	479
123. Artery constrictor (Mr. Speir's)	480
124. Roussel's injecting apparatus	485
125. Inflammatory change in artery that precedes atheroma	489
125A. Atheroma of artery	489
126. Section of artery plugged by an embolus	493
127. Sacculated traumatic aneurism	494
128. Multiple aneurisms	495
129. Laminated clot from aneurism	497
130. Section through cured aneurism	498
131. Mode of applying pressure to femoral artery for the cure of aneurism	504
132. Weiss's double pad for pressure	504
133. Mr. G. Cole's pad for elastic pressure	505
134. Dix's mode of compressing artery	509
135. Diagrams showing the different operations for aneurism	512
136. Drawings illustrating the collateral circulation in the lower extremity after the application of a ligature to the external iliac artery	519
137. Different forms of arterio-venous aneurism	520
138. Aneurismal varix of axillary vessels	521
139. Mr. Cock's case of arterio-venous aneurism	522
140A. Cirsoid aneurism of temporal artery	523
140B. Cirsoid aneurism of foot	524
141. Degenerating nævus	526
142. Mode of ligaturing nævus	527
143. Effects of nævus of upper lip	528
144, 144A. Modes of ligaturing large nævi	528
145. Needle for the application of a subcutaneous ligature to a nævus	529
146. Diagram illustrating the application of a ligature to an artery	531
147. Best form of aneurism needle	531
148. Incision for the application of a ligature to aorta or common iliac artery	533
149. Operation for ligaturing common carotid and facial arteries	537
150. Operation for ligaturing the subclavian and lingual arteries	542
151. Ligature of axillary artery	543
152, 153. Ligature of brachial artery	544
154. Ligature of radial (upper third) artery	545
155. Ligature of radial and ulnar arteries	546
156. Ligature of external iliac and femoral arteries	547
157. Ligature of posterior tibial artery	552
158. Ditto behind malleolus	553
159. Ligature of anterior tibial artery	554
160. Ligature of dorsalis pedis	555
161. Drawing illustrating case in which the inferior vena cava was obstructed	562
162. Varicose veins	564

Fig.		page
268.	Fourth variety	733
269.	Reduction *en masse*	733
270.	Oblique inguinal hernia	737
271.	Direct inguinal hernia	737
272.	Femoral hernia	737
272A.	Author's pad for truss	740
273A, 273B.	Diagrams showing mechanism of strangulation of the bowel	743
274.	Drawings illustrating effects of strangulation of the bowel	746
275.	Stricture of bowel, result of strangulated hernia	748
276A.	Key's operation for hernia	754
276B.	Drawing illustrating the relative position of the abdominal rings from within	754
277.	Hernia knives	755
278.	Spica bandage	758
279, 279A.	Drawings illustrating the second variety of displaced hernia (Bell's)	761
280.	Interstitial hernia with ruptured neck of hernial sac—third variety	762
281.	Drawing illustrating the intra-parietal or fourth variety of displaced hernia	763
282.	Wood's operation for radical cure	770
283.	Obturator hernia; external view	778
284.	Ditto; internal view	778
285.	Congenital umbilical hernia	779
286.	Rectum ending in cul-de-sac above anus	786
287.	Enormously distended rectum in man after operation for imperforate rectum in infancy	788
288.	Speculum for examination of rectum	795
289.	Operation for anal fistula	799
290.	Internal hæmorrhoids	802
291, 292.	Forceps for hæmorrhoids	806
293.	Clamp for hæmorrhoids	807
294.	Prolapsus recti	809
295.	Villous polypus of rectum	811
296.	Microscopical drawing of ditto	812
297.	Cancerous stricture of rectum	816

"Only the association of medicine with surgery forms the perfect physician. The physician who is deficient in the knowledge of one of these branches resembles a bird with but one wing."

Art of Life (Ayur Veda): early Sanscrit, first century of Christian era.

"I dressed his Wound, and God healed it."

Ambroise Paré.

"All that we have to do, is not to obstruct nature in the execution of those offices, to which she is generally fully equal, in which we can lend her no assistance beyond removing impediments out of her way."

P. Pott, 1773.

"Surgery consists in curing a disease rather than in the removal of it by mechanical means. But so differently do most think upon this subject that a surgeon who performs most operations and gives most pain is commonly thought the best."

John Hunter, MS. Lectures, 1787.

THE

PRACTICE OF SURGERY.

INTRODUCTORY CHAPTER.

SURGERY is of a twofold nature. It is a science and also an art—a department that requires to be known and another to be practised. The science embraces a knowledge of the character, the causes, and the effects of disease and injury, and also of the processes by which they are best repaired; the art consists of the treatment of diseases or injuries as they present themselves, which to be successful, must be based upon the science. At the bedside, the phenomena of disease must be studied, its symptoms recognised, and duly weighed. In the post-mortem room its effects are to be traced. The great object of the student, therefore, should be clinical and pathological investigation, the study of the living and the dead, since it is by these alone he can hope to acquire a solid basis on which to ground his practice.

Skilled and unskilled observation.

The external features of a local disease may appear the same to the student as to the most accomplished surgeon; whereas the phenomena of disease are often perceptible to the latter alone—the acquired art of observation and the unconscious influence of experience giving to the mind of the one a power of recognition and interpretation which is denied to others.

It is to the acquisition of this power, therefore, that the student should devote his energies, and to this end cultivate the art of observation, for by it he will not only gain the power of seeing correctly, but also of interpreting the meaning of what he sees, and will thereby acquire a diagnostic acumen which cannot otherwise be obtained.

On diagnosis

It is now necessary to consider by what method a correct opinion can be formed in any given instance; how sources of fallacy are best eliminated and a good diagnosis established, for it cannot be too forcibly impressed upon a student's mind that the treatment of a case will not be successful unless based on a clear understanding of its wants, and that these can never be duly appreciated where a correct diagnosis of its nature has not been made.

The mind of the Surgeon should invariably be judicial; it should possess nothing of the advocate, but be so regulated as to be able to put aside all prejudices and preconceived ideas, and avoid the advocacy of all unsupported theories and hypotheses; it should be open to accept clinical phenomena as they are observed, and arrive at a conclusion cautiously and clearly after duly balancing the facts of the case, and carefully weighing the possibilities and probabilities of its nature.

Its principle. To form a diagnosis of a case mainly on probabilities as indicated by symptoms may be a ready, but it will always prove a rash proceeding. To form it on possibilities, will be a safe, although, perhaps, a less expeditious course. The Surgeon who acts upon the first method must, at times, fall into grave errors, although his diagnosis will often appear brilliant and may be successful; while he who habitually forms an opinion after taking into consideration every possibility of the case, and comes to a result by a process of exclusion, must surely, on the whole, be more certain in his ends, as he will be safer and sounder in his practice. I lay down therefore the following proposition as a guiding principle of investigation applicable alike to all cases of injury as well as of disease.

Reasoning by exclusion. *That in the diagnosis of a case, every possibility of its nature should be entertained, and a conclusion arrived at by a process of elimination; each possibility should be separately considered and weighed, and the most probable finally accepted; a diagnosis wholly framed on probabilities being most hazardous.*

Example. For example, a tumour at the femoral ring may *possibly* be either an abscess, an aneurism, a varix, cyst, hernia, enlarged gland, or a new growth. An abdominal tumour may be ovarian, uterine, peritoneal, vesical, splenic, fæcal, renal or hydatid. Its probable nature will be best arrived at by eliminating each of these possibilities *seriatim* after a due consideration of all its clinical symptoms: the most probable diagnosis being finally accepted on evidence both negative and positive.

How to diagnose. With the above great principle of practice as a guide in clinical investigation, I now proceed to consider how any injury or disease is to be investigated, confining my observations to classes of injury and disease. I do not propose, however, to point out here the exact mode in which it is well to examine a case or to report it—for a report is only a written examination—although at pages 7 and 8 an outline will be seen, which may probably be found of service. I drew it out many years ago when surgical registrar at Guy's, where it has been generally followed ever since.

How to Investigate a Case.

When a Surgeon is called to a patient, his questions naturally apply first of all to the seat of disease or injury. Is it in the head, chest, abdomen, or extremities? He will then ask as to its duration or when the injury was received? or when was the disease discovered? If a case of injury, his inquiries would tend to elicit the exact mode of its production, the force employed, and the character of the instrument by which it was produced; for these points are of essential importance under all circumstances, and in head injuries they often give the key to the solution of many questions. By these means the exact seat of injury will probably be indicated, and the Surgeon will be led to make a close examination of the injured part; but he should never fail to assure himself that all other parts of the body are sound and in working order, and that no other is involved in disease, or is the subject of injury; for it would be a forlorn hope to amputate for a crushed limb when associated with a ruptured liver, or to reduce a dislocated joint when combined with some fatal internal lesion.

In a case of injury to or disease of the head or nervous system, the most important point the Surgeon has to determine has reference to the

exact seat of the affection. Is it confined to the soft parts covering the bone, or are the contents of the skull in any way involved? because, in the former, the affection is comparatively of small importance; whereas in the latter, its gravity cannot be too highly estimated. Scalp wounds, however severe, have as a rule a successful ending; whilst brain injuries, however trivial, should always be regarded with apprehension, for they may lead to the most serious complications. Example, brain injury.

When no signs of brain disturbance after an injury have been observed the diagnosis is not difficult, for without symptoms, local or general, a surgeon may be excused from entertaining the idea of brain complication; although he should know that cases of fractured base have taken place without any symptoms to suggest the presence of such an injury. When indications of brain disturbance exist, the difficulty arises, for it cannot be too firmly impressed on the student's mind that the same symptoms may be produced by concussion as by compression of the brain; and that bone pressing on the brain, and blood effused upon its surface, or within its structure, give rise to precisely the same phenomena; he should know that the symptoms produced by apoplexy the result of a ruptured vessel, and by hæmorrhage into the brain from an injury, are almost identical, and that those produced by what is called functional disturbance of the brain closely resemble those caused by organic mischief. Whilst, therefore, it is imperative on the student of surgery to remember, that a variety of different conditions may give rise to apparently identical clinical symptoms; he must know that the clinical *history* of each of these cases will, on inquiry, be found to differ widely, and that it is to the collateral evidence of the case he must look, to find the right clue to a successful diagnosis. Value of clinical history.

Where no clinical history can be obtained, the difficulties of diagnosis are indeed great; thus, when a surgeon is called to see a man who has been found in the street, insensible; who is in fact in an apoplectic condition, and has, at the same time, some external evidence of injury to his skull; and may perhaps also smell of spirits. The questions that arise in the surgeon's mind under these circumstances are very conflicting. Did this man have a fit and then fall, or, are the symptoms due to a brain injury, the result of an accident? Was he knocked down and injured, or, was the injury the consequence of a fall? Are the symptoms caused by drunkenness, or, how far are they complicated with it? Are they the result of blood-poisoning from kidney disease, or, poisoning by opium?

To unravel all these points great care and discrimination are required. Too much, indeed, cannot be bestowed upon the task, because to treat an apoplectic seizure, or a case of severe brain injury from external violence, for drunkenness, is a grave error; but, unfortunately, it is one which is not uncommon. To mistake drunkenness for apoplexy or severe head injury, is, perhaps, a less grave, although it is, without doubt, a serious fault. As a matter of policy, however, it is generally a wise rule to regard all these suspicious cases from the more serious point of view, and to watch and wait for symptoms to indicate the practice that should be pursued. Rule to adopt.

What I wish therefore to impress upon the student is the necessity of bearing in mind that all these different conditions alluded to present to the surgeon many features in common, and that a correct

diagnosis can only be arrived at by a process of exclusion. The possibilities of the case having thus been reviewed, the probabilities can only be weighed by a rigid inquiry, even into the minutest circumstances that can be ascertained.

Example, local paralysis.

In cases of local paralysis the difficulties of diagnosis are very great. Is the cause a *central* one—that is, is it in the brain or cord? or is it *peripheral*—at the termination of the nerves? or, is it *local* without being quite peripheral? If one or two of the former causes be in operation, the history of the case will probably form a true guide to the surgeon; and in the latter, some local injury to the nerves supplying the part, some tumour or aneurism pressing upon the nerves, will probably be found; or, perchance it may be a case of lead palsy or infantile paralysis. But under any circumstances, a true diagnosis can only be made by eliminating from consideration the many possible causes and adopting the most probable.

Compare sound with affected side.

Again, *It should be an invariable rule of practice in every case of injury or disease, to compare the sound with the affected side of the body.* In the diagnosis of a dislocation or fracture, the information gained by the comparison often furnishes at a glance to the experienced eye a true suggestion as to the nature of the accident; and in joint disease, any effusion into a joint, or enlargement of the bones is, as a rule, readily detected.

The nature of the disease or injury being thus suggested to the mind through the eye, the suggestion remains to be confirmed or corrected by a careful manual examination, by the other clinical symptoms, and by the history of the case; the facts elicited by the sight, by the hand, and by the ear, being made separately available, and the conclusion drawn after a careful balancing of the probabilities and possibilities of the case. The diagnosis will be well established when all these different modes of investigation lead to one conclusion.

Bedside experience.

In surgery, as in medicine, the student must educate the eye to see and the hand to feel; and the task is by no means simple or easy; indeed, it is one of the most difficult to learn, and cannot be begun too early in his professional career. Reading will not help, nor thought aid; personal experience at the bedside alone will supply the want.

To recognise the existence of a wound, or the deformity of a broken bone, may not be difficult; but to read aright the endless phenomena which a wound presents, and to make out the character or tendency of a fracture, requires much experience. To see that a swelling exists in a part is open to the uneducated eye; but to recognise the various aspects that different tumours assume, to make out their form, position, and attachments, to estimate their consistence, to recognise the fluctuation of fluid, whether superficial or deep, and to detect pulsation, require considerable tactile power and long education. What education also is demanded in order to read the phenomena presented in diseases of the eye or the skin! "No study of the written observations of others could enable any to appreciate those endless varieties of the pulse which entirely baffle description, or to distinguish between the warmth of the skin, excited by various accidental causes, and the pungent heat accompanying the first stage of pneumonia, or acquaint him with the shrunk and shrivelled features derived from the long-continued disease of the abdominal viscera—the white and bloated countenance often attendant

on changes in the functions or structure of the kidney—the squalid and mottled complexion of the cachexia dependent upon the united effects of mercury and syphilis—the pallid face of hæmorrhage—the warm hue of amenorrhœa—the dingy whiteness of malignant disease—the vacant lassitude of fever—the purple cheek of pneumonia—the bright flush of phthisis—the contracted features and corrugated brow of tetanus; all which shades of countenance, with many more that might be enumerated, are distinctly recognised by the experienced eye." Yet all this, and something more, is to be acquired by means of trained observation, and no labour on the student's part should be considered too great for its attainment. Dr. Bright, 'Guy's Hosp. Rep.,' 1836.

Diathesis.—This subject claims the attention of the surgeon, on account of its undoubted bearing on practical surgery. In the *strumous*, *scrofulous*, and *tuberculous diatheses*, all of which appear to be closely allied, there is, no doubt, a tendency to glandular enlargement, the formation of caseous deposits and a low kind of inflammatory action, whether in the bones, joints, skin, or lungs; but beyond these clinical facts we know nothing. Disease in subjects who have these diatheses is precisely identical in its essential nature with the same disease in others who have them not. It may be modified in its course by the diathesis, but it is the same. These names have, likewise, no special signification when applied to local affections. On Diathesis

It is important to bear this fact in mind, for there can be little doubt that the expressions "strumous disease" and "scrofulous disease" have had an injurious influence on the practice of surgery. They have too often led the surgeon (and misled the public) to regard a local affection in a strumous or scrofulous subject as incurable, as depending on some constitutional condition, and not on a local cause. In disease of the joints this error has been much felt, and should be rejected.

The investigations of Drs. Sanderson and Fox in our own country, and Dr. Waldenburg abroad, tend, however, to show that the *scrofulous* diathesis, in which there is a tendency to inflammation of a low type, gives rise, under some circumstances, to *tuberculosis*, and that local inflammatory affections of a chronic nature are specially prone to be followed by tuberculous disease. The grey granulations or tubercles are apparently derived from some pre-existing inflammation; from the absorption into the blood of the *caseous* or *cheesy* deposits which are supposed to be the residue of an antecedent inflammatory action—whether in the bones, joints, glands, or lungs, and these are subsequently disseminated in the form of miliary tubercle. Niemeyer, indeed, maintains that "the formation of tubercle never takes place unless preceded by pneumonia, terminating in caseous infiltration of the pulmonary tissue." To the surgeon this aspect of the case is of immense importance, for it is clearly his duty, under these circumstances, to hasten the recovery of local suppurative disease as much as possible, and where this cannot be carried out, to remove it. For let it be once shown that local disease has a direct influence in producing constitutional dyscrasia—call it by what name we will—and the necessity of dealing actively with chronic local affections becomes a duty. I have occasionally acted upon this principle with the best results, and in more than one case in which there was progressive lung mischief associated with a diseased knee have found the lung affection speedily subside after amputation. It must likewise be admitted that a local Scrofulous. 'Die Tuberculose und Scrofulose,' von Dr. L. Waldenburg Berlin, 1869. Connection between local suppurative disease and tubercle.

disease in a strumous subject, may be as amenable to treatment as it is in a more healthy one. The treatment may indeed require some modification from the fact of its occurring in such a subject, but the principles of practice, in both the strumous and the non-strumous, are the same, although we know that in the former all diseased action is of a low type, and that there is always a greater tendency to degenerative changes than we find in other subjects. Some pathologists have been bold enough to say that the scrofulous diathesis is the consequence of hereditary syphilis, but evidence is wanting to substantiate this view.

Hæmorrhagic.

Hæmophilia, or the *hæmorrhagic* diathesis, as the result of heredity, is a subject of peculiar interest to the surgeon, and is to be distinguished from a temporary disposition to bleed, which is present in purpura or leucæmia, and is often acquired. It attacks the boys of a family rather than the girls, and when bleeders beget children, all, as a rule, appear healthy, but when the girls have families, their boys, as a rule, are bleeders. It may appear at the very earliest period of life. It manifests its presence by a peculiar tendency to bleeding on the slightest provocation, and by the difficulty there is in arresting hæmorrhage when it does take place. The surgeon should always have before him the possibility of his patient being a subject of this diathesis; for although it would not prevent the performance of any operation essential to save life, it would materially affect the question of operating for any reason of expediency, and would influence the practice adopted.

W. Legg, 'St. Barth. Hosp. Rep.,' 1881.

The bleeding may take place from any part of the body, or into any cavity. It may be venous or arterial, and may occur without any definite cause, or follow some slight injury. The swelling of the joints, which takes place in this affection, in some cases is due to hæmorrhage, but in others to serum. In a drawing in my possession the synovial membrane was found after death covered with beautiful fine fringes, stained a deep orange colour from effused blood. Sir W. Jenner states that in these cases "the tissues are soft, and bruise easily; the blood is slow in coagulating, although it coagulates as firmly as in health; that is, blood is formed rapidly, and there is a tendency to plethora of the small vessels, and that when the patient is looking his best, injuries have the worst effect, and spontaneous hæmorrhages are most likely to occur." In this disease, therefore, he advises a mercurial and saline purge every three weeks, dry food, with a considerable portion of dry fibrinous meats, and plenty of open-air exercise; great care being observed to avoid injuries. The bleeding, as a rule, ceases spontaneously. In the acquired disease iron is of great value.

On cachexiæ.

Cachexiæ.—Do they exist? Is there any definite aspect associated with any definite disease? Is there a cancerous cachexia? I have little hesitation in stating that in practice no such thing can be established, and, that a large number of patients suffering from cancer are as healthy looking as any other class, if not often healthier. There can be no doubt that a patient, suffering from cancer which, by its discharges or development, interferes with the important functions of life, and undermines his powers, has an anxious, drawn, bloodless, and waxy appearance; but so has the subject of any organic disease which interferes with the functions of digestion and assimilation, and particularly the subject of intestinal disease. The patient exhausted by suppuration, by spinal, bone, or joint mischief; the man or woman who from drink,

syphilis, or mercury (separately or combined), is gradually being brought down to death's door, has a cachexia more or less peculiar according to the organ involved in the disease, and the special constitution of the patient; but it is merely the condition of looking ill. Clinically, I read the meaning of a cachexia as "looking ill," perhaps very ill, from some long-standing or slowly-acting cause; but it has no other definite signification than "looking ill" from cancer, "looking ill" from abdominal, rectal, suppurative, or syphilitic disease.

POINTS FOR ENQUIRY IN SURGICAL CASES.

Disease or Injury. Date when seen. Result.

NAME, age, occupation, residence, general health, habits, and aspect. In some cases hereditary history.

HISTORY OF PRESENT DISEASE OR INJURY.—Its assigned cause or method of production.

ORDER OF SUCCESSION OF SYMPTOMS, with their former treatment, and date of any marked change in either symptoms or treatment.

PRESENT CONDITION AND APPEARANCES; passing in review, and noting when irregular the condition of intellect, senses, and nervous system. Organs of respiration and circulation. Pulse—frequency, force, volume, compressibility, distinctness and rhythm. Temperature. Digestive Organs—tongue, appetite, bowels. Urino-genital Organs—urine, catamenia. Integuments—eruptions, moist or dry; above or below natural heat. Locomotive organs—bones, joints and muscles; whether paralysed or in undue action.

PREVIOUS DISEASES OR INJURIES, with their dates. Treatment.

PROGRESS OF THE CASE.—Note carefully any change in the old, or the appearance of new symptoms, with the date of change, and treatment, by medicine, diet, &c., &c. Carefully fill in the result, and date of departure; if unfavorable, the condition on post-mortem examination.

NOTE.—As the value of a Report depends upon its conciseness, together with the accuracy and number of recorded observations, it is unnecessary to write one, unless an appreciable change in the symptoms exists.

SPECIAL POINTS FOR OBSERVATION.

HERNIA.—Variety and character—its position, period of existence, assigned cause, and form; whether previously irreducible, and if a truss had been worn.

When STRANGULATED, give the symptoms, *general and local*, dating from the exact period of strangulation, the first appearance of sickness, character of vomit.

PREVIOUS AND PRESENT TREATMENT.—If by *taxis*, state whether forcible, and how long applied, with or without chloroform; when by *operation*, if sac was opened *or not*—if opened, *why?* its contents and their appearances. On reduction, note the time from the first symptoms of strangulation; success, immediate and final.

WOUNDS.—Variety, position, extent, and depth; how, and with what produced; *when on scalp*, if exposing bone. Complications—hæmorrhage, &c. Treatment and result—whether united by adhesion or granulation.

TETANUS.—Idiopathic or Traumatic, partial or general; time of appearance after injury; position and condition of wound. Death—whether from spasm or exhaustion.

DISLOCATIONS.—Form and position; simple or compound; how and when produced previous Treatment.

SYMPTOMS, general appearance and position of the limb; mobility, pain, amount of injury to soft parts. Treatment—time after injury; by manipulation or extent sion; mode of application of *extension, with its direction* and duration, chloroform, additional *means employed. Result, immediate and final.*

FRACTURES.—Simple or compound, or comminuted; how and when produced; position and direction of the line of fracture; its tendency; amount of injury to vessels and soft parts; in *Compound*, note position, and extent of wound; if produced by the primary force or broken bone, what vessels, nerves, or joints are involved. Constitutional symptoms.

TREATMENT.—Sand bags, starch bandage, splints, form of splint applied; date of application. Note the date of any change of local or general Treatment.

FRACTURED SKULL.—Position; kind of injury and direction of the force; if attended by hæmorrhage, its amount, and whether from nose, mouth, ear, or external wound. Give evidence, if any, of brain mischief.

IN SUSPECTED FRACTURED BASE.—Paralysis of facial nerve; flow of blood or serum from ear, with the time of its first appearance after the injury and its duration; condition of hearing; state of vision, and of pupils; presence of subconjunctival hæmorrhage. If complicated with internal injury, as *concussion, compression, &c.*; carefully report symptoms in their order of succession, and whether immediately following the injury or not; the duration, and amount of unconsciousness, insensibility; paralysis, its position, motion, sensation, or both; condition of sphincters; character and number of pulse, respiration; condition of skin. Treatment, &c.

DISEASED BONE.—Part affected; duration; cause, as external injury, syphilis, mercury; extent; superficial or deep, partial, or general; previous Treatment, especially as regards operations.

PRESENT SYMPTOMS AND APPEARANCES.—Condition of dead bone or *Sequestrum*, fixed or loose; number and position of openings, or *external cloacæ*, with the date of their first appearance.

TREATMENT.—If by operation, its immediate success.

DISEASES OF JOINTS.—Part affected; date of first discovery; assigned cause, as injury. Note the early symptoms, in the order of their appearance; and date of any fresh symptom or marked change; if pain or uneasiness preceded swelling, or was coeval with it; if the former, how long? Rapidity of progress; previous Treatment, and its effects.

PRESENT APPEARANCES.—Position of joint; if flexed, the angle of flexure; size and shape.

CHARACTER OF SWELLING.—Uniform or bulging; manipular indications, hard, soft, elastic or fluctuating; mobility, amount; if attended with grating, &c.; in the knee-joint, note if the patella be free or not; if free, the sensation felt on moving it; condition of skin; if fistulous openings exist; their position, number, and character of their discharge; deep or superficial; note the date of their first appearance, and if natural or artificial. Pain, acute or gnawing: its position, general or local; if aggravated by motion, or interarticular pressure; if increased at night. Sleep, if disturbed by crying or starting of the limb; sympathetic pain, and its position; condition of muscles of limb; constitutional symptoms. Treatment.

STRICTURE.—Organic or traumatic; duration and assigned cause, especially as regards gonorrhœa; use of injections, or accident; if previously treated by Catheter; complications, as abscess, fistula, with their position and date of appearance.

RETENTION.—Mention period of retention; preceding symptoms, and cause, as stricture, calculus, paralysis, abscess, prostatic disease, &c. Constitutional and local symptoms; previous and present Treatment; puncture per rectum, note the date of removal of the canula and arrest of the flow of urine through the wound.

EXTRAVASATION.—Cause, over-distension or accident; duration of retention before urethra gave way, and period that elapsed before being seen. Describe the appearances and extent of parts infiltrated; constitutional symptoms and Treatment.

VENEREAL DISEASE.—Chancre, duration; Position; glandular, urethral, coronal, or frænal—external, internal, or fringing preputial; character, indurated, non-indurated, aphthous, raised, excavated, irritable, phagedænic, or sloughing; tubercle; condition of inguinal glands, indurated or inflamed. *Previous Treatment*, particularly as regards mercury.

COMPLICATIONS.—Note the date or appearance, and situation of each or any of the complications; the order and time of their occurrence after the primary sore. Present appearance and Treatment of each.

GONORRHŒA.—Date of contraction; former treatment, especially as regards injections, copaiba, &c. Complications, and their duration; in epididymitis, if following suppressed discharge; use of injections, copaiba, or violent exercise.

STONE IN BLADDER.—When discovered; date of earliest symptoms; if preceded by the passage of sand; amount of irritability of bladder; character of urine; consti-

faecal and local symptom. Treatment—Lithotrity or Lithotomy; in latter, note any peculiarity; date of arrest of the flow of urine through the wound.

TUMOURS.—Date of its discovery and size; rapidity of growth; general and local symptoms, in their order of appearance. General health prior to discovery, and since; hereditary tendency; assigned cause; depressing influences. In Mammary Tumours, number of children; date of birth of last; if ever suckled with affected breast, when; condition of the catamenia, if ceased, how long? Previous Treatment, and success.

PRESENT CONDITION AND APPEARANCES.—Position of tumour; size, shape; external aspect and condition of skin; Pain, and its character; condition of lymphatic glands; manipular indications; mobility, when in breast, whether moved by traction of the nipple; Feel, hard, elastic, &c., &c. Constitutional symptoms.

TREATMENT.—In recurrent growths, give the date of former operations; date when healed; and of its first reappearance, and position.

OPERATIONS.—Describe position, direction, and number of external incisions; the steps of the operation as performed; its duration; number of vessels tied or twisted, and amount of hæmorrhage. In Amputations, the part amputated, and position of amputation. In Flap operations, give the position of the flaps; whether anterior, posterior, or lateral; whether performed by perforation or external incision. In the combined flap and circular, note the position of the skin flaps; in all, note the result and character of stump.

CHAPTER I.

ON WOUNDS, REPAIR, AND INFLAMMATION.

FROM a clinical point of view, wounds may be divided into the **open** and the **subcutaneous**, if we exclude those by which animal poisons are introduced into the system, such as dissection wounds, the stings of insects, bites of snakes and rabid animals, and the wounds which afford an entrance to the poison of glanders, malignant pustule, and last, but not least, syphilis. The term "*open*" is applied to all injuries caused by external violence—the result either of accident or, as in an operation, of design—in which there is a solution of continuity in the soft tissues, and in which the deeper parts are exposed to the influence of the air through a more or less gaping orifice. The term "*subcutaneous*" is applied to such injuries as follow external violence, in which the deeper tissues, bones, or viscera are broken, ruptured, lacerated, or crushed, without any breach in the continuity of the soft parts covering them, and consequently without their exposure to the influence of the external air; as well as to such operations as may be made by the Surgeon through a small external or open wound, as in tenotomy, myotomy, and osteotomy.

Open wounds.

Subcutaneous wounds.

"Open" wounds are more serious, as a rule, than the "subcutaneous," though the latter, when large vessels and viscera are concerned, are among the gravest injuries the Surgeon has to deal with. Open wounds, moreover, heal by a more complicated process than the subcutaneous, and are exposed to risks from which the latter are free.

Classification of Open Wounds.

Varieties of wounds.

When made by a sharp-edged instrument, either by accident or in an operation, wounds are said to be *incised; when inflicted* by a blunt instrument that *tears they are called lacerated;* and when caused *by one that bruises, contused. Wounds caused by* the thrust of a

pointed instrument are called *punctured*, though when the weapon is sharp, the tissues are simply pierced and cut deeply; but when blunt, irregular in shape, or increasing in diameter from the point towards the handle, the soft parts are forced asunder as by a wedge, and are consequently stretched and contused. A punctured wound under some circumstances approaches the character of the incised, and under other circumstances that of the contused form of injury. As a matter of fact, however, nearly all wounds of soft parts are more or less contused; those inflicted with a very sharp instrument being, of course, the least so.

Simple or complicated.

A wound is called "*simple*" when it has been made by a clean, sharp-edged instrument in a healthy subject, and when there is nothing in the nature of the wound itself, or in the state of the patient to prevent or retard repair, provided that the injured part be placed in a favorable position for the reparative process to be carried out. The wound is called "*complicated*" when there are foreign bodies lodged in the part interfering with repair; when it is attended with hæmorrhage, with much contusion or laceration of tissue; or when from the peculiarity of the patient there are nervous symptoms, severe pain, constitutional disturbance, or local inflammation; or when repair is interfered with by the presence of such complications as bad health or old age.

Incised Wounds.

Incised wounds.

Open incised wounds are best seen as the result of operations, but they may also be well studied as clean cuts accidentally made with sharp-edged instruments. They may *gape* from the elasticity or contractility of the tissues divided; may *bleed* from the division or wound of small or large vessels; and may give rise to variable degrees of *pain*, according to the number or character of the nerves involved, and according to the susceptibility of the patient.

Gaping of skin.

The amount of "gaping" in a wound varies with the tissue divided. *Skin*, which is the most elastic tissue in the body, retracts when divided far more than other tissues, and transverse wounds of skin gape more than those which are longitudinal.

Of arteries.

Arteries, when wounded transversely or obliquely, gape much, and when completely divided across retract far into the tissues. Divided *veins* retract less than arteries. *Muscles*, when their fibres are cut across, shorten rapidly by contraction, and thus aid the gaping of a wound. *Fibrous tissues* and nerves when divided retract but little. All wounds, however, which are made in parts in a state of tension gape much; and tissues which are on the stretch when divided, retract far more than they would do if they were relaxed. Thus, an incision made into the full breast of a suckling woman will probably by gaping appear as wide as it is long; while one made into the same organ in a flaccid state would gape but little. Some tissues, on the other hand, never gape on division; this is best seen in wounds of the palm of the hand and of the sole of the foot.

The Surgeon takes advantage of these known conditions of gaping and retraction of tissues, and in his operations so places on the stretch the parts to be divided, as to enable him to make a clean and decisive section of the tissues with which he is dealing—a single sweep of the

knife made under these circumstances, doing the work of many when made under others less favorable.

Hæmorrhage from Incised Wounds.—The "bleeding" that attends an incised wound depends principally upon the size, number, and character of the vessels that are divided, although it may be influenced by the personal peculiarities of the patient, and more particularly by the fact of his being a "bleeder" or not; or, in other words, by his being or not being a subject of the "hæmorrhagic diathesis." The condition of the wounded part, moreover, whether inflamed or otherwise more than normally supplied with blood has some influence, and the effects of position must always be taken into account. Bleeding in.

Putting aside, however, those peculiarities, constitutional and local, the myriads of vessels that are divided in a wound made in a healthy subject with sound tissues, rapidly if not instantaneously close on the removal of the dividing medium; for it is a fact that capillary bleeding after an incised wound rapidly ceases by natural processes. That which goes by the name of "hæmorrhage" is due to the issue of blood from wounded arteries of some size, or from wounded veins, and the bleeding, if it does not prove rapidly fatal, persists till nature's hæmostatic processes—unassisted or assisted by art—have time to act.

Pain of Incised Wounds.—The "pain" attending an incised wound varies in its nature and degree, according to the position of the wound and the tissue wounded. Some portions of the body, such as the skin of the face and fingers, the orifices of the mucous tracts, the periosteum, and tense tendons, are far more sensitive than the skin of the back and buttocks, the bones and the fasciæ. The sensibility of the patient has likewise much to do with the degree of pain experienced, so also has the condition of the nervous system at the time at which the wound is received. Not only may one subject of an operation be far more sensitive than another, but the same subject may feel pain more acutely at one time than at another; the general condition of the physical powers, and more particularly of the nervous system, greatly influencing sensibility. Unexpected or unseen wounds, or wounds received during drunkenness; or when the mind is intent on other things, as in the excitement of battle, are often unfelt, or felt but slightly; whereas when the mind of a patient is fixed upon the performance of an operation, the evil influence of anticipation aggravates his suffering. Pain in.

Local and Constitutional Effects of Incised Wounds.

The "local effects" of a simple incised wound on a healthy subject may extend little beyond the breach of surface, and the slight pain and bleeding which attend the injury. The "constitutional effects" may be so slight as to be unobserved. In a general way, however, local as well as constitutional effects show themselves, and these are greatly influenced by the extent of the wound, the general condition of the patient, and the treatment to which the injured part and the patient have been subjected.

Local Effects.—These are best studied in a deep incised cut, which has passed through skin, subcutaneous fat, and fascia. Local effects.

The wound, directly after its infliction, will gape, and, after the lapse

of but a brief interval of time, this gaping will increase, so that the subcutaneous fat will appear as if it were being pressed out of its position, and as if the divided edge of the skin were retracting from it, and becoming everted. Within an hour, or an hour and a half, the edges of the wound will be seen to be *swollen*, and slightly *red*, from increased vascularity; and, if the connective tissue of the wounded part is loose, as in the eyelid or male genital organs, it will be puffed up, and œdematous. To the patient, the part will feel hot and stiff, and it will be the seat of a dull, aching, or burning pain. The edges of the wound will also probably be more sensitive,—the amount of pain depending much upon the *tension* of the parts, and upon the treatment to which they have been subjected. If the edges of the wound have been stitched together, and the parts are much swollen and œdematous, there will be tension upon the wound, and a disposition to separate and gape. In a healthy subject, however, when repair goes on well, all these local phenomena will subside and disappear in the course of two, three, or four days, according to the rapidity and perfection of the healing process, and a cure will then take place. But should the local phenomena above described be more persistent, increase in severity, spread beyond the margins of the wound and surrounding parts, or alter in character for the worse, what has been a physiological reparative process will pass into a pathological or diseased one, and the parts will then be said to be "inflamed."

Redness and swelling.

Tension.

Constitutional Effects.—The "constitutional phenomena" associated with these local changes vary greatly. In some subjects, a trivial local injury, a mere cut, may give rise either to a more or less severe "shock," or to a disturbance of the nervous system which expresses itself in convulsions; whereas in other persons, a severe and extensive wound may be followed by few if any constitutional symptoms.

Shock.

"Shock."—The gradations of shock and collapse are innumerable, and the symptoms by which they are characterised vary from a passing faintness or disturbance of the heart's action, to fatal syncope. The state of collapse may be regarded as a chronic syncope. Patient may unquestionably die from "shock" following slight injuries or minor operations, though no satisfactory cause for death may subsequently be discovered, the heart's action being suddenly stopped through some central nervous influence.

Collapse.

The degree of "shock" that attends an accident or operation depends, as a rule, upon the importance in the animal economy of the organ injured; the extent and nature of the violence which the tissues have sustained, the size of the blood-vessels which have been involved, and the amount of blood which has been lost. A patient in good health will bear a severe wound or operation with little shock, while another with diseased viscera, and more particularly with diseased kidneys, will be subjected to severe shock from even a trivial injury.

The age and constitutional condition of the patient have an important influence under all circumstances.

"Reaction."—When what has been described as the period of "shock" after an accidental or operative wound has passed away, the stage of "reaction" is reached, and in a general sense it may be assumed that the intensity of this stage is fairly governed by the intensity of that which preceded it; that is to say, where there has been little shock there will

Reaction.

be but feeble reaction; and where the shock has been severe or prolonged the stage of reaction will be of a like type. Still this rule has innumerable exceptions, and these exceptions seem to depend more on the individual peculiarities of the patient than anything else; one person, after a slight injury or operation, experiences little shock, but sharp reaction; while another, suffering from a severe injury or operation, will have a prolonged stage of shock, followed by no more reaction than seems to be necessary to restore the circulation to its normal condition, and to allow the functions of the body to work efficiently.

Children and women, and the subjects of neurotic tendencies, always react rapidly, and in a marked way, from all kinds of shock, whether mental or physical, but, as a rule, they do well. The rigors, nervous tremblings, and fears, which are often met with in nervous subjects after operations, and which often cause alarm, are but rarely followed by any bad results.

Symptoms of.

The *symptoms of reaction*, in their mildest expression, are simply those of the restoration of the circulatory and nervous functions to their normal condition. The heart, with the circulation generally, so rallying from the depressed condition into which it has been thrown by the "shock" of the accident or operation, as to come up to the usual standard of health; and the nervous system so recovering from the temporary state of depression, if not of unconsciousness, into which it has been cast, as to resume its normal power of governing and controlling the actions of the body over which it presides. The reparative process consequently under these circumstances may be expected to go on uninterruptedly to a successful issue. The wound will undergo repair, and heal, and the subject of the wound will suffer little or no constitutional evil beyond that occasioned directly by the injury. The stage of reaction in a clinical sense will then be normal, it will be such as may be said fairly to balance that of shock, and to tend towards recovery.

Traumatic fever.

Traumatic Fever.—When the symptoms of reaction, either with respect to intensity or duration, exceed the normal standard; when the circulatory system acts powerfully and rapidly, the respirations increase in quickness, the brain and special senses become abnormally active, and the temperature of the body rises, and remains above that of health; and when with this elevation of temperature the functions of the body generally are disturbed and work badly, as indicated by thirst, a foul tongue, loss of appetite, constipation, diminished secretion of urine, want of sleep or disturbed rest, "traumatic fever" is said to exist.

This fever may show itself the day after the injury or operation, or may not appear till the second day, and it may last for twenty-four, forty-eight, or seventy-two hours. When the case is going on satisfactorily towards recovery, the fever seldom lasts beyond this period. Should the symptoms, however, continue, dangers are to be apprehended and difficulties looked for. When the fever runs on into the fifth or sixth day, the Surgeon may be sure that some complication is present; and, should the symptoms be still more fixed, the probabilities are that the case is not only badly complicated, but that it will pass on to a fatal issue.

Vide paper by Author, 'Lancet,' June 5th, 1880.

Temperature chart.

Under all *circumstances, and in the treatment of* every wound, accidental or operative, *the eye of the Surgeon should be* steadily fixed on

Diagram illustrating the process of repair in a wound filling up by granulation.

(This drawing has been made for me by my friend, Mr. Howse, from microscopical sections of granulation in his possession.)

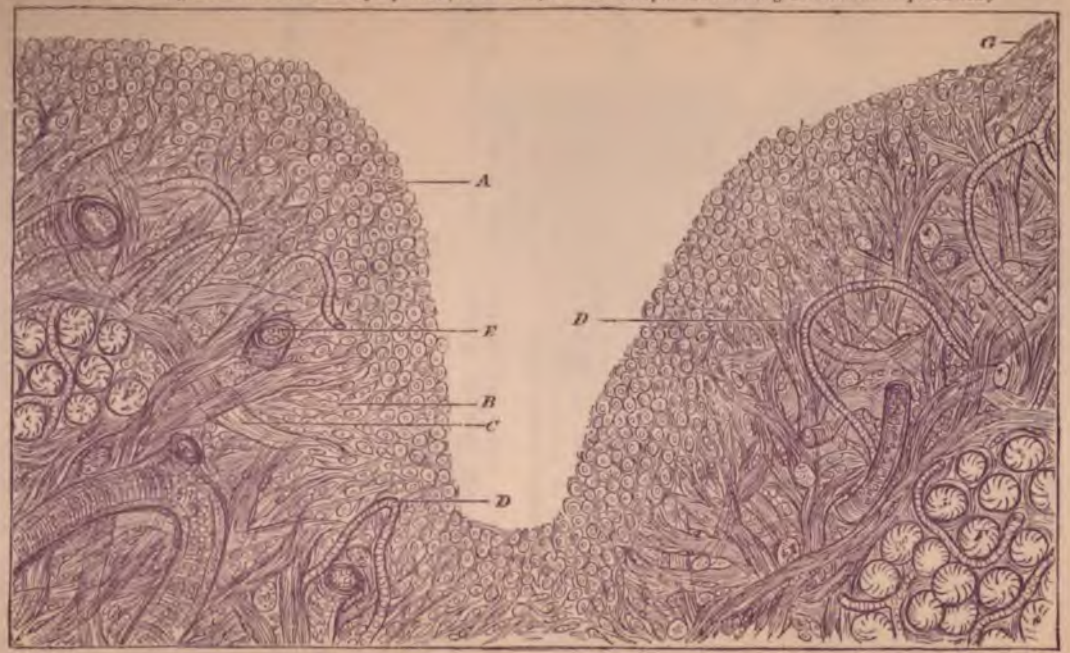


FIG. 2.

A=Granulation-cells with single or double nuclei. These, when shed, are pus-cells. *B*=The same cells becoming spindle-shaped. *C*=Intercellular element becoming developed into bundles of white fibrous tissue. *D*=Capillaries. *E*=Small arteries. *F*=Fat-vesicles forming lobules. The two last structures constitute part of the original subcutaneous tissue. *G*=Superficial cells becoming converted into epidermal scales.

To face page 15.

itself, as Virchow affirms, or whether the cells are the white corpuscles of the blood which have escaped by exudation from the capillaries, as Cohnheim would lead us to believe, I do not now care to inquire. All admit, however, the multiplication of cells in the affected tissues (*vide* Fig. 2). Professor Redfern writes, "The facts must be recognised; the floating blood-cells are really the very cells which once formed the substance of the lymphatic glands, the spleen, and other organs; and they do, in fact, move through the walls of the blood passages, and wander about freely in what are called solid tissues." When we recollect how penetrable the tissues of an animal are, we shall cease to be startled at seeing them become the seat of entirely new deposits, or finding them traversed by migrating blood-corpuscles as freely as a colloid is penetrated by a crystalloid. Address at British Association, 1874.

Cicatrisation.—Let us now inquire briefly how cicatrisation proceeds, and note that it is in the cells that the most important changes are to be recognised. Those nearest the injured part gradually assume a spindle shape, and the intercellular tissue into which these spindle-shaped cells are infiltrated becomes denser. The spindle-shaped cells then gradually change into ordinary connective-tissue corpuscles, and in this way new cicatricial tissue is formed. This new tissue, however, again undergoes changes—changes of consolidation. The intercellular tissue becomes gradually more condensed, and the spindle-shaped cells assume the flat shape of connective-tissue corpuscles, and in a measure disappear, the nucleus often alone remaining. The fluid that existed in the newly-formed tissue is absorbed, and the new cicatrix by degrees becomes firmer and denser, gradually contracting, so that at last the delicate scar of a large wound becomes solid and compact. The cicatrix in smaller wounds appears only as a thin red, and at a later period as a white line. Cicatrisation.

Changes in the capillaries of the part are, however, going on during all this period; but how far *all* the changes that have been briefly described are due directly to the capillary action is not yet determined. If Cohnheim's views be adopted, it is to the capillaries that the chief action in the tissues must be ascribed; but if those of other pathologists, such as Virchow and Billroth be accepted, the capillary action takes a secondary place, and the cell elements take the leading one. On either theory the importance of the capillaries cannot be overlooked. Changes in capillaries.

With regard to the changes in the capillaries, it has been already pointed out that at the beginning of the reparative process, the capillaries of the part become sealed, and the collateral circulation in the neighbourhood becomes irregular and pressed upon; and that the coagula in these obliterated capillaries become reabsorbed or possibly reorganised as repair progresses, since it is certain that the capillary network soon becomes continuous through the newly-formed cicatricial tissue, and that the capillary meshes of the one side join by loops projected through the new tissue similar meshes of the opposite one.

What influence the nerves of the part have upon the reparative process we do not know. That they have an important influence there can be little doubt, since all physiologists recognise their power upon secretion and nutrition; the vaso-motor nerves doubtless have the greater power. But we must learn something more of nerve power Influence of nerve on reparation.

generally and nerve distribution—something of the way in which the nerves terminate in the tissues, and what relation they bear to the capillaries—before we can hope to find out or understand the exact influence nerve supply has on repair.

c. Repair by granulation.

Repair by Granulation.—All wounds do not, however, heal by immediate union, or by primary adhesion, *i.e.* first intention; and wounds that gape cannot so unite. The process of repair in them, differs, therefore, somewhat in its character from the process in those which we have been considering; it *takes place by granulation*, or the "second intention of Hunter." If we closely examine the surface of a wound thus exposed, we shall find that it becomes within a few hours of its exposure covered with a film of a peculiar gelatinous, greyish-white appearance, which will be seen with the aid of the microscope to be composed of granulation-cells or white blood-cells, "Hunter's plastic lymph." After an interval of some hours the parts covered with this gelatinous greyish film become more vascular, as indicated by redness, and the surface more even. The film itself assumes a tougher character, and a yellow fluid, which is mixed with small yellow sloughs of fibrinous tissue, is secreted. The wound begins "to clean," and to have a smooth and consistent surface. After the lapse of another day, or some days, perhaps, this surface is covered with a number of elevations, known by the name of *granulations*, varying in size from a millet-seed to a hemp-seed, the smaller being highly vascular and red, the larger being, as a rule, paler and more bloodless. The wound at this time is "granulating," and the secretion from it is now of a creamy-yellow character, and is called *pus*. The granulations, are made up of cells called granulation cells, which resemble inflammatory lymph-cells; and each granulation contains a vessel, the walls of which consist of a thin membrane, in which nuclei are embedded. "Some of these nuclei are arranged longitudinally, others transversely to the axis of the vessels. In the development of these vessels changes occur, answering to those seen in ordinary embryonic development. Organisation makes some progress before ever blood comes to the very substance of the growing part; for the form of cells may be assumed before the granulations become vascular. But for their continuous active growth and development, fresh material from blood, and that brought close to them, is essential. For this, the blood-vessels are formed, and their size and number appear always proportionate to the volume and rapidity of life of the granulations. No instance would show the relation of blood to an actively growing or developing part better than it is shown in one of the vascular loops of a granulation imbedded among the crowd of living cells, and maintaining their continual mutations. Nor is it in any case plainer than in that of granulations, that the supply of food in a part is proportionate to the activity of its changes, and not to its mere structural development. The vascular loops lie embedded among the simplest primary cells, or when granulations degenerate, among structures of yet lower organisation; and as the structures are developed, and connective tissue formed, so the blood-vessels become less numerous, till the whole of the new material assumes the paleness and low vascularity of a common scar" (Paget.)

Development of granulations.

Secretes pus.

Section of granulation.

Their vascularisation.

Formation of new skin.

If, at this time, when the granulations have attained to the level of

the skin, we look to the margins of the wound, we shall see a dry, red band of newly-formed tissue, with an outer border of a bluish-white colour, where it comes into contact with sound integument. This band is the new skin forming, and is caused by the gradual growth of the epidermis from the margin of the sound skin towards the centre of the sore. Such a process is called "*cicatrisation*." The cicatrix is at first red, as in the linear cicatrix, to which we have already alluded, but, as it contracts, it subsequently becomes paler, more compact, and adherent. The nature of the scar or cicatrix varies with the tissue in which it is formed, the new connecting medium under all circumstances having a powerful tendency to approach the peculiar character of the tissue in which it is placed. Thus, a cicatrix in skin in time closely resembles true skin; a cicatrix in bone, true bone; and a cicatrix in tendon becomes tough and hard, like tendon. Under all circumstances the consolidating reparative material partakes of the character of the parts which it connects.

Consolidation of cicatrix.

Secondary Adhesion.—When two granulating surfaces are brought together, and union takes place between them, *Healing by "secondary adhesion,"* or by *the "third intention,"* is said to occur. The process of repair, under these circumstances, is similar to that of immediate or adhesive union, the two layers of granulations adhering either directly or by means of some new material, as two surfaces of divided tissue. The capillaries and embryo cells, under both circumstances, undergo changes such as have been described. For this form of union to take place, the granulations, however, must be healthy.

Secondary adhesion or union by third intention.

Scabbing.—When wounds *heal "by scabbing,"* granulations do not form. In this process the reparative material which is poured out undergoes at once similar changes to those already described as taking place in adhesive union, and the wound cicatrises rapidly beneath the scab; for the serum of the blood when effused on the surface of a wound, is of a highly plastic character, and quickly coagulates to form a film of a protective nature, under which repair may rapidly proceed; the embryo cells, with this—Hunter's "plastic lymph"—being the medium of repair. The treatment of superficial wounds is based upon the knowledge of this process, and the value of felt, cotton wool, or any similar material, when applied to an open wound, entirely depends upon this plastic property of serum. Repair by scabbing is doubtless the best form of healing, although it is, unfortunately, somewhat rarely obtained.

d. Repair by scabbing.

The Nature of the Healing Process is physiological, and resembles closely that of development and growth. The changes in the cell elements which have been described in repair, and the gradual development of the most elementary tissue into cicatricial tissue or higher structures of the human body, are similar in nature if not in form to those which are witnessed in the embryo, when the blastoderm cells, or primary nucleated mass of protoplasm, in the ovum, grow, develop, and differentiate into the various structures of the human animal.

Nature of healing process.

For the healing processes there must be a sufficient blood supply for nourishment, and there must likewise be a regulating force to control and direct the formative process, and this force doubtless comes from the nerves.

When the vascular supply is deficient, growth or development must suffer, and the physiological process of repair cannot go on; when the vascular supply is in excess, what would have been a physiological, becomes a pathological process, and the part undergoing repair after injury is said to be "inflamed." The process of *construction*, under these circumstances, ceases, and that of *destruction* may ensue; or there may be changes in the now inflamed but formerly repairing wound or granulating surface, which will be considered under the heading of "Diseases of granulations." What I would now impress upon the reader, is, that whatever action is required for the healing process is physiological, and is just equal to its purpose; when it is excessive, it becomes pathological, and is known as Inflammation.—Inflammation, when it attacks a wound, at first checks repair, and later on brings about disorganising changes; inflammation, under all circumstances has a destructive tendency.

Difference between repair and inflammation.

Regeneration of tissue.

Regeneration of Tissues.—It has already been pointed out that the processes of repair are identical in all tissues; that the reparative process in bone or muscle, integument or tendon, capillary or nerve, is the same, such modifications alone showing themselves as necessarily appertain to the histology of the tissues; and it is well that this physiological truth should be fully recognised. At the same time, it is to be equally recognised that all tissues are not formed out of cicatricial or connective tissue, but that the higher forms of structures, such as muscle, nerve, bone, &c., are repaired by the regenerating influence of the injured tissue itself, new cells springing or growing by a kind of budding process from the divided ends of the injured part; the new cells in contact with, or poured out by, the injured tissue, whether as embryo cells, connective-tissue cells, nerve cells, muscle cells, or bone cells, being so influenced by the tissue with which they are in contact, and from which they probably originated, that they anatomically partake of its nature, and bring about its repair.

Of muscle.

Repair of Muscle.—When *muscular tissue* is wounded, or more or less destroyed, O. Weber tells us that it may be restored, and that the young muscular fibres are formed out of the old by the division of the protoplasmic material of their extremities; the repair of muscle being thus brought about by agencies closely simulating those of fœtal development. Gussenbauer gives a drawing of the process. Billroth, however, asserts strongly that he has never seen anything which he could regard as a re-formation of muscular fibres, and that the cicatrix in muscle is almost entirely connective tissue; the extremities of the muscular fibres, after division and repair, uniting with the cicatricial tissue in the same way as they do with the tendons. My own observations go to confirm those of Billroth.

Syd. Soc., Billroth, 'Surg. Path.,' vol. i, s. 151.

vide Dr. Weir Mitchell in the 'American Journal of Med. Science' for April, 1876, 'Clinical Society's *Trans.*,' *vol. xii.*

Repair of Nerves.—There is good reason to believe that an injured or even a divided nerve may be thoroughly repaired, since conclusive evidence has, in recent times, been adduced to prove that such a large trunk as the median, the ulnar, or the great sciatic, may be divided, and subsequently so joined by surgical skill as to secure after the lapse of a certain interval of time, perfect union of the divided ends, as proved by the complete restoration of the functions of the nerve in their physiological perfection.

It is likewise true that new cicatricial tissues become sensitive

t parts which by accident or operation, have been deprived
nfluence of one nerve, regain their sensibility, either by the
of new nerves, or by the assumption on the part of another
of the same nerve, or of another nerve, of the physiological
s of the one that has been destroyed.

these facts the conclusion is clear that nerve tissue must be Regeneration of nerve.
ted, and that the divided ends of nerve must reunite by new
aterial. It seems, moreover, highly probable that new nerves
elop. In a physiological point of view, these facts are not only
narkable, but they tend to demonstrate the perfection of the
ve process—since to allow of the conduction of nerve force
from the nerve centres, very powerful conductors are unques-
required.

rocess by which this repair is brought about has been care-
ndied by Schiff, Hjelt, and others, and is much after the
g fashion, as given by Billroth:—"There is first of all a Billroth, vol. 1, p. 152.
ation of the medullary sheath, possibly also of the axis-cylinder,
rtain distance from the injury, which is quickly followed by
duction of cells in the neurilemma; these develop into spindle
d spread into the tissue which intervenes between the nerve-
nal which extends also between the cut extremities of the nerves.
hese cells, as in the embryo, nerve fibres are developed, and
erve fibres ultimately cannot be distinguished from ordinary
bres."

Sources of Interference with Healing of Wounds.

lifferent modes of healing, and the processes by which injured Causes of non-repair.
re repaired, having been fully described, I propose to consider
ses that interfere with, retard, or prevent repair; and these
found either in the "*wound itself*," in the "*subject of the*
" or in "*its treatment*."

Causes.—Amongst the causes which exist in the wound itself, *a.* Foreign bodies.
ence of any foreign matter whatever must be placed first, since
ar that where such is found, even to a limited extent, repair by
ate, primary, or quick union is impossible. The foreign matter
y, by its presence, mechanically prevents the adhesion of the
s between which it is placed, but also acts as an irritant, or as a
r of septic changes, and thus excites an action in the wound,
s not reparative, but inflammatory. The truth of this general
not disproved by the fact that, in exceptional cases, foreign
become encysted in tissues, and give rise to but little

occurrence or persistence of bleeding in the wound is a second *b.* Hæmorrhage.
use of non-repair, the reparative process not commencing until
eding, even capillary oozing, has been arrested. When the
rhage is great, this interference may be serious, and even when
t is enough to retard and prevent the reparative process from
arried out. Blood, if effused to any extent between the sides of Effused blood.
d, interferes with the reparative process much in the same way
a foreign body, and forbids all healing by quick or primary ad-
If effused *in very small quantities between the* divided surfaces,
at times possibly change into cicatricial tissue, and form a band

When the vascular supply is deficient, growth or development must suffer, and the physiological process of repair cannot go on; when the vascular supply is in excess, what would have been a physiological, becomes a pathological process, and the part undergoing repair after injury is said to be "inflamed." The process of *construction*, under these circumstances, ceases, and that of *destruction* may ensue; or there may be changes in the now inflamed but formerly repairing wound or granulating surface, which will be considered under the heading of "Diseases of granulations." What I would now impress upon the reader, is, that whatever action is required for the healing process is physiological, and is just equal to its purpose; when it is excessive, it becomes pathological, and is known as Inflammation.—Inflammation, when it attacks a wound, at first checks repair, and later on brings about disorganising changes; inflammation, under all circumstances has a destructive tendency.

Difference between repair and inflammation.

Regeneration of tissue.

Regeneration of Tissues.—It has already been pointed out that the processes of repair are identical in all tissues; that the reparative process in bone or muscle, integument or tendon, capillary or nerve, is the same, such modifications alone showing themselves as necessarily appertain to the histology of the tissues; and it is well that this physiological truth should be fully recognised. At the same time, it is to be equally recognised that all tissues are not formed out of cicatricial or connective tissue, but that the higher forms of structures, such as muscle, nerve, bone, &c., are repaired by the regenerating influence of the injured tissue itself, new cells springing or growing by a kind of budding process from the divided ends of the injured part; the new cells in contact with, or poured out by, the injured tissue, whether as embryo cells, connective-tissue cells, nerve cells, muscle cells, or bone cells, being so influenced by the tissue with which they are in contact, and from which they probably originated, that they anatomically partake of its nature, and bring about its repair.

Of muscle.

Repair of Muscle.—When *muscular tissue* is wounded, or more or less destroyed, O. Weber tells us that it may be restored, and that the young muscular fibres are formed out of the old by the division of the protoplasmic material of their extremities; the repair of muscle being thus brought about by agencies closely simulating those of fœtal development. Gussenbauer gives a drawing of the process. Billroth, however, asserts strongly that he has never seen anything which he could regard as a re-formation of muscular fibres, and that the cicatrix in muscle is almost entirely connective tissue; the extremities of the muscular fibres, after division and repair, uniting with the cicatricial tissue in the same way as they do with the tendons. My own observations go to confirm those of Billroth.

Syd. Soc., Billroth, 'Surg. Path.,' vol. i, s. 151.

vide Dr. Weir Mitchell in the 'American Journal of Med. Science' for April, 1876, 'Clinical Society's Trans.,' vol. xii.

Repair of Nerves.—There is good reason to believe that an injured or even a divided nerve may be thoroughly repaired, since conclusive evidence has, in recent times, been adduced to prove that such a large trunk as the median, the ulnar, or the great sciatic, may be divided, and subsequently so joined by surgical skill as to secure after the lapse of a certain interval of time, perfect union of the divided ends, as proved by the complete restoration of the functions of the nerve in their physiological perfection.

It is likewise true that new cicatricial tissues become sensitive,

and that parts which by accident or operation, have been deprived of the influence of one nerve, regain their sensibility, either by the growth of new nerves, or by the assumption on the part of another branch of the same nerve, or of another nerve, of the physiological functions of the one that has been destroyed.

Regeneration of nerve.

From these facts the conclusion is clear that nerve tissue must be regenerated, and that the divided ends of nerve must reunite by new nerve material. It seems, moreover, highly probable that new nerves may develop. In a physiological point of view, these facts are not only very remarkable, but they tend to demonstrate the perfection of the reparative process—since to allow of the conduction of nerve force to and from the nerve centres, very powerful conductors are unquestionably required.

Billroth, vol. 1, p. 152.

The process by which this repair is brought about has been carefully studied by Schiff, Hjelt, and others, and is much after the following fashion, as given by Billroth:—"There is first of all a degeneration of the medullary sheath, possibly also of the axis-cylinder, for a certain distance from the injury, which is quickly followed by the production of cells in the neurilemma; these develop into spindle cells, and spread into the tissue which intervenes between the nerve-fibrils, and which extends also between the cut extremities of the nerves. From these cells, as in the embryo, nerve fibres are developed, and these nerve fibres ultimately cannot be distinguished from ordinary nerve fibres."

Sources of Interference with Healing of Wounds.

Causes of non-repair.

The different modes of healing, and the processes by which injured tissues are repaired, having been fully described, I propose to consider the causes that interfere with, retard, or prevent repair; and these may be found either in the "*wound itself*," in the "*subject of the wound*," or in "*its treatment*."

a. Foreign bodies.

Local Causes.—Amongst the causes which exist in the wound itself, the *presence of any foreign matter* whatever must be placed first, since it is clear that where such is found, even to a limited extent, repair by immediate, primary, or quick union is impossible. The foreign matter not only, by its presence, mechanically prevents the adhesion of the surfaces between which it is placed, but also acts as an irritant, or as a promoter of septic changes, and thus excites an action in the wound, which is not reparative, but inflammatory. The truth of this general rule is not disproved by the fact that, in exceptional cases, foreign bodies become encysted in tissues, and give rise to but little trouble.

b. Hæmorrhage.

The *occurrence or persistence of bleeding* in the wound is a second local cause of non-repair, the reparative process not commencing until all bleeding, even capillary oozing, has been arrested. When the hæmorrhage is great, this interference may be serious, and even when little, it is enough to retard and prevent the reparative process from being carried out.

Effused blood.

Blood, if effused to any extent between the sides of a wound, interferes with the reparative process much in the same way as does a foreign body, and forbids all healing by quick or primary adhesion. If effused in very small quantities between the divided surfaces, it may at times possibly change into cicatricial tissue, and form a band

of union between the divided parts; and under these conditions it may become organised, as when poured out on the brain; but, as a rule, the effusion of much blood into a wounded part is a retarder of repair, or a cause of non-repair.

Clot of blood in wound.

When a wound has to heal by granulation, a clot of blood, as a covering, kept aseptic, is beneficial, since it acts as a protector to the surface of the wound, and allows the granulating process to go on uninterruptedly. It has been said that such clots become organised, but it is far more probable that they simply act, as above described, as a protection to surfaces that are granulating.

c. Contusions and lacerations.

A *contused or lacerated* surface in a wound is a third local cause of non-repair, and it is well to recognise this important fact, since, with such a condition of parts, the Surgeon knows that immediate or primary union of the wound is not to be expected. Under these circumstances, a line of treatment will be indicated, which will be far more likely to be efficient than one based on the hope of obtaining quick repair. When the contusion or laceration is slight, the hope of securing primary union of the divided parts may indeed be entertained, but when it is great, such a hope would be altogether groundless. The gradations of contusion and laceration between these two extremes are numberless; but it will be wiser for the Surgeon to believe, and upon such a belief to act, that in contused and lacerated wounds the prospect of obtaining quick union is slight, than for him to act upon an opposite view, and attempt to obtain, in severe cases, a mode of healing the occurrence of which is improbable if not impossible.

In a contused or lacerated wound the Surgeon should mentally see dying or dead matter, which, of necessity, must be separated from the living parts, and got rid of, either by molecular disintegration, or by a coarser sloughing process, before the act of healing can rightly be said to begin; and under these circumstances he will at once recognise the futility of entertaining a hope of obtaining the repair of the wound by quick union.

Influence of age in repair.

Constitutional Causes.—Of the causes of non-repair which are to be put down to the account of the subject of the wound, "*age*" is all important, the reparative process in a man the wrong side of fifty being conducted with less vigour than in one who is on the right. In the very old repair is at its lowest mark. The same remarks are applicable to patients who are the subject of "*organic disease*," or of *degenerative changes* in their tissues, and especially to fat and soft tissued people; the old in years, or in infirmities, not possessing the recuperative powers of the young and vigorous. Under these circumstances, in the case of a wound resulting from accident or operation, in a patient over fifty years of age, or in one in ill-health, it would be wrong for a Surgeon to expect, or to rely upon securing, a mode of repair which, in a younger or healthier subject, he might reasonably look for.

Of disease.

People who are advanced in years, or who are feeble from frailty or disease, particularly visceral disease, have no, or an insufficient, capital at the bank of health to draw upon. Of all subjects for wounds, whether accidental or operative, the habitual drunkard is the worst.

Defects in Treatment.—Of the causes of non-repair which are to be attributed to treatment, a want of due care in maintaining the injured or wounded part in a state of rest, claims the first place; for in such a

delicate process as is that of repair, it is plain that in any movement of the injured part, whether in the way of separation of surfaces or by manipulation, the process may be interfered with or retarded, or the work already accomplished may be undone. It is certain that the best and most rapid repair of an injured part takes place when the wounded tissue is kept in an absolutely immovable position, and when the wounded surface is protected from all external influences that can possibly interfere with the physiological reparative process. It therefore clearly behoves the Surgeon to have this great truth always before him, in order that he may adapt his treatment to the requirements of the case, and not have to blame himself for a want of care in maintaining that absolute immobility of the wounded or cut part, which is essential for rapid or even good repair. Want of rest

In the treatment of fractures, the evil effects of want of rest and immobility of the broken bones are well exemplified; but it is to be remembered that the same want of rest and immobility is as pernicious in wounds of the soft as in those of the hard parts; in wounds of the surface as in those of the deeper structures. The term "want of rest" is here used in its fullest sense, as want of that thorough immobility of tissue and non-interference, which are all-important for the rapid perfection of the physiological reparative process.

Again, if the edges of a wound are allowed either to gape, or to have too much tension upon them, repair will be interfered with; the parts in both cases, from either want of care in their adaptation, or want of caution in not making due provision for the escape of the redundant fluids (drainage), or from some over-action (inflammation), not being allowed to remain at rest and undergo repair. Gaping of wounds

Over-action in the vessels of a part which is undergoing repair—that is, inflammation—always has an evil influence. When it shows itself early in the case it prevents repair, and when manifested at a later period it retards the healing process, or even causes its retrogression. Indeed, under all circumstances, when the vascular action of a part which is undergoing repair exceeds what is essential for the steady perfection of the process, the repair of that part is interfered with. Inflammation when it attacks a wound, at first checks repair, subsequently undoes it, and at a still later period brings about disorganising changes; under all circumstances it has a destructive tendency. Hyperaction or inflammation. Effects on repair.

The student having learned how wounded parts heal by nature's processes, and more particularly how simple incised and open wounds are repaired; and having, moreover, learned to recognise some of the most important influences which retard, if they do not arrest, repair, will readily understand the more favorable conditions under which repair can be carried out, and, what is more, will at once appreciate the surgical requirements of the case he may have to treat, so that, as a Surgeon, he may know when and where to apply his art, how he can help nature in her beneficent action, and how he can best guard against the intrusion of any outside influences that may tell against the steady progress of the reparative process. For it cannot be too strongly asserted that the best Surgeon is the one who best understands natural processes in the *repair of parts, and who knows how to* use them to the *greatest advantage; who recognises the fact that* these natural pro-

cesses are exact, and when applied to the healing of wounds, undeviating; who knows that if he is to utilise these natural processes to the full he must bring up his art of curing to nature's line, under the conviction that nature never systematically bends herself, or puts forth her hand to help the curer; that she never deviates from her path; that if, using Dr. Richardson's words, "we do not molest her she goes on, as we say, naturally towards a cure; if we molest her a very little, she goes on, and the molestation is but little shown; if we molest her vehemently, she still goes on, showing molestation in proportion to disturbance, nature under all circumstances going her own way, caring just as little for ease as for pain, for life as for death." When a bone is broken, nature will heal it quite irrespectively of the position in which it is placed; when a knuckle of bowel is strangulated, nature will cast it off, quite regardless of the effects of such a sloughing act. But the Surgeon who knows this, knows, moreover, that the same natural process will work on when the bone is "set" in a right position, and maintained there by art; and that the sloughing may be avoided when the strangulated bowel is relieved by art from its false position, and placed where it can be best repaired by nature's means.

Treatment of Wounds.

Of a simple incised wound.

In the treatment of a *simple* cut or incised wound, in which there is no dirt or foreign matter to keep the edges of the wound asunder, and to act as an irritant; in which there is no hæmorrhage beyond capillary or venous bleedings, which can be arrested by elevation of the part, moderate pressure, or the application of a cold or hot sponge; the Surgeon has simply to cleanse the wound, bring its edges carefully together, and adopt means to keep them so; while at the same time he makes such provision for the protection of the wound as may secure it from injury from without or within, and may allow the reparative process which has been described as taking place in primary union to be quietly perfected.

Of more severe wounds.

In *more severe wounds* a similar practice is to be advocated, though some care may be called for in cleansing the wound; more caution required in the arrest of bleeding; and more ingenuity demanded in bringing the edges of the wound together, as well as in so fixing the injured part in position that the patient may be comfortable, while the wound is kept immobile and protected from such injurious outside influences as would interfere with the healing act. Provision, moreover, will have to be made for efficient drainage, that is, for the free exit of such sanguineous or serous fluids as are commonly exuded after severe wounds or operations, and the retention of which always proves injurious.

Upon each and all of these points, therefore, a few lines may not be without value.

On Cleansing Wounds.—After full examination of a wounded part, and careful consideration as to the mode of its production, the extent of injury, and the requirements of the case for cure, the wound should be cleansed. This should be effected with all completeness and gentleness, since, on the one hand, everything like a foreign body between the lips of a wound would, of necessity, prevent quick or primary union, and would, in all probability, prove injurious to the subsequent progress of

the case; while, on the other hand, anything like roughness would be detrimental to the already injured tissues. To effect this cleansing with gentleness, a stream of water, medicated with some antiseptic, is the best means for the Surgeon to employ, and this stream may be brought

FIG. 3.



Irrigating bottle, and apparatus.

to bear upon the part by using the irrigating bottle or the irrigating can (Fig. 3) I have figured above. The stream of fluid washes away blood with all light foreign matter, and what cannot be washed away may be removed with fingers or forceps. In gunshot wounds, special forceps and other instruments may be required.

Those who believe atmospheric germs to be the chief cause of inflammation and suppuration, or of most, if not all, the ills to which wounded flesh is heir, will employ the means that are supposed to be capable of destroying such malignant foreign visitors, and for this purpose will use the spray of carbolic acid, one part in forty, or other antiseptic, to kill the germs in the air as they approach the wound, and will dress the wound with the carbolic lotion, carbolic gauze, protective, and waterproofing, according to directions laid down in a future page (*vide* Listerian method of dressing wounds); whereas *those* who disregard atmospheric *germs, and yet highly value means for* purifying wound *surfaces, will use antiseptic irrigation of the* wound with a lotion of

Listerism.

Antiseptic irrigation.

To purify wound.

carbolic acid 1 to 20, of thymol 1 to 1000, of chloride of zinc 20 grains to the ounce (originally used by Mr. C. de Morgan many years ago), or of iodine, made by adding 10 drops of the liquor iodi to the ounce of water. I have employed the iodine lotion for years, and prefer it to any other. It is always at hand, and is both simple and effectual as a wound cleanser. The lotion may be used warm, and it has the advantage of not only cleansing the wound in the fullest sense of the term, for iodine is an antiseptic, but it has a marked tendency to arrest all capillary bleeding or oozing. I use it in about the proportions given above, but the best practical guide is to pour the solution or tincture into a basinful of water, so as to make the latter of a light sherry colour.

Arrest of Bleeding.—It is well that hæmorrhage should be effectually arrested by some of the various means which the Surgeon has at his command before the edges of a wound are brought together; and it is wise to have even capillary bleeding stopped, when it is possible, for blood, effused in even limited quantities between the surfaces of an incised wound is to be regarded much in the light of a foreign body, and as forming an obstacle to repair, more particularly when primary union of the wound is to be sought for. Indeed, it was on this account that I was first led to employ, for cleansing wounds, the iodine water to which I have drawn attention, and which I cannot too strongly recommend for general adoption. A sponge wrung out of this lotion (made with hot water), and held to a wound for a minute, completely checks all oozing of blood, and tends more than anything else, except prolonged exposure to the atmosphere, to the formation of that glaze upon the surface of the wound which so much conduces to satisfactory repair.

Iodine lotion to check oozing.

On the Question of Repair by Primary or Secondary Adhesion.

When the Surgeon has cleansed the wound, removed what foreign bodies may have been present, and stopped all bleeding, he has to decide upon the means whereby the reparative process may be best helped, and, as a primary point, to determine either the feasibility or expediency of attempting to obtain *quick* or *primary union* of the cut parts, or the wisdom of looking to their repair by the slower *open, granulating* process.

When quick union is to be expected.

When the wound is of the *incised* kind, the question is not difficult to answer; for it may with confidence be asserted that, with few exceptions, in all wounds of this description, whether superficial or deep, accidental or the result of operation, repair by quick or primary union is to be desired, and, what is more, may be expected, if the subject of the wound be healthy and not too old, and if nature's reparative process be so aided by surgical art as to be allowed to take its course without interference.

The cleaner the cut is the greater is the probability of its uniting by quick repair; the more ragged, contused, and lacerated the margins of the wound are, the less are the prospects of obtaining primary union, and the less the wisdom of making the attempt; between these two extremes are innumerable gradations. Where there is a doubt about the wisdom of making the attempt to secure primary union in deep, contused, and lacerated wounds, let the decision be against it;

and when the doubt applies to the more superficial or hopeful class of wounds, let it be decided in its favour. Care must, however, be taken in these, as in all cases, to give up the attempt on the appearance of the slightest local or constitutional symptoms. It is also necessary to bear in mind that, by drawing together the parts by sutures, &c., some retained blood, serum, or sloughing tissue, may keep them in a state of *unrest*, either by tending to separate the lips of the wound, and exciting tension, or by undergoing chemical changes and decomposition, and thus favouring the production of some septicæmic or pyæmic conditions. For it must be recognised, that whilst in the cleanest incised wound there *may* be no death of the divided tissues, and consequently no animal matter to undergo chemical changes or putrefactive decomposition; in the contused and lacerated there *must* of necessity be more or less.

Necessity of death of tissue in certain wounds.

When tissue dies, it must be shed or cast off from the living parts before the physiological reparative or uniting process can take its course. When this dead tissue has been separated from the living, it ceases at once to be influenced by the vital processes by which it had been built up, kept clean, and eventually cast off; it consequently becomes subject to the physical laws of all dead matter, and undergoes chemical changes—which means too often decomposition.

The object of the Surgeon, therefore, in the treatment of these cases of wound in which the death of tissue is to be expected, and cannot be prevented, is to neutralise as far as possible the evil influence of its death and probable decomposition. This is to be achieved by so dealing with the injured part that the dead tissue may find a free outlet for its discharge, and by rejecting all such applications or dressings as are likely to help putrefactive decomposition; at the same time employing means and agents likely to neutralise its pernicious influence, and to control in a measure the process of decay.

How to ward off its evil effects.

Treatment to Help Quick or Primary Union.

To promote the primary union of a wound the Surgeon has six cardinal indications to follow:

The six cardinal points to be observed.

1. To cleanse the wound.
2. To arrest all bleeding.
3. To effect coaptation of the two divided surfaces of the wound—the deep parts as well as the edges.
4. To maintain the wounded parts in a position of immobility beneficial to the natural process of repair, as well as comfortable to the patient.
5. To secure drainage of the wound by providing for the escape of such dead tissue as may be thrown off, as well as of all fluids that are not required for repair.
6. To protect the external wound from all such outside influences as may be prejudicial.

The first two *indications have been already* considered, viz. the *cleansing of the wound and the arrest of bleeding* (pp. 22, 24). In

all forms of wound, and for every form of healing, attention to these points is most important, but when quick or primary union is to be expected, it is all essential.

Third Indication—The Coaptation of the Edges and Surfaces of a Wound.

The coaptation of the two divided surfaces of the wound may be efficiently carried out in superficial or not deep wounds by means of sutures and adhesive plaster, separately or combined. When by the use of trustworthy adhesive plaster the object sought for can be obtained, sutures are not called for; and when sutures are used, the form of suture that carries out the object in view in the simplest way is the best.

Deep and superficial sutures.

Interrupted Suture.—When the wound is *superficial* the sutures need not be introduced deeply; but when the wound is *deep*, the practice of bringing the edges of the wound and not the deeper parts together, is fraught with danger, since the repair by primary union which is looked for cannot take place, and between the separated surfaces of the deeper parts of the wound, blood, serum, or inflammatory fluids will collect and give rise to trouble. Hence in deep wounds the sutures should either be all introduced deeply, or deep as well as superficial sutures should be employed.

The *interrupted* (Fig. 4) is the most useful form of suture, and it is applicable to *superficial* as well as to deep wounds. It can be made with a curved or straight needle, according to convenience, armed with a single thread of well waxed silk, wire, or fishing gut, the fine silk line sold by tackle makers being the best for ordinary purposes. The needle should be introduced through one side of the wound obliquely from without inwards, and made to pass through the opposite side in the reverse direction from within outwards. The knot of the suture should be brought to one side of the wound, as shown in fig. 4. In the *superficial*, it should be inserted with sufficient depth and closeness to bring the surfaces and edges of the part accurately and closely together, and it should be tied with enough force to carry out these objects, but not with more; since to tie a suture as a surgeon would a ligature is to do harm, as the suture would cut rapidly through the strangulated tissues, and in so doing irritate the part instead of helping repair.

FIG. 4.



The interrupted suture.

Deep sutures.

In *deep* wounds the suture must be inserted deeply, as in hare-lip operations, and introduced well away from the edges of the separated tissues, so that when they are tightened the deeper parts as well as the superficial will be brought effectually into apposition. In some cases deep and superficial sutures may be made to alter-

nate. Superficial sutures should include neither muscle nor deep fascia.

A double-reef knot is usually employed, but a "granny" (Fig. 120) is by no means a bad one to make, since it is a slip knot and can be tightened at pleasure by a third tie.

In the majority of cases in which sutures are employed it is an excellent plan to alternate the sutures with strapping; a narrow band of the latter carefully adjusted between the stitches not only materially aids the adaptation of the edges of the wound, but, if well applied, tends to prevent tension, and to immobilise the wounded structure, while at the same time it acts in the way of affording local pressure to the deeper parts of the wound. In operations on the breast the advantages of this practice are well exemplified.

Continued Suture.—The uninterrupted, continued, or Glover's suture (Fig. 5), the stitch of the sempstress, is valuable in all cases in which a very close and accurate adaptation of the margins of the wound is wanted, as in wound of the intestine, as well as in those of the eyelids and face generally; indeed, a clean wound of these parts—superficial or deep—may be so accurately and well adjusted by means of a fine needle and thread as to leave but a minimum of scar. In operations about the lip, the same remarks are applicable, although, in these, care should be observed to introduce the sutures deeply, and well away from the margins of the wound. In operations for phymosis, in the adult, this form of suture is likewise of great value, as it not only expedites recovery, but does much to make the result of the operation more artistic. In these cases the fine carbolised gut suture may be used. The stitches should be removed on the third or fourth day. They may often be taken out of the face on the second. If left in long, they are apt to set up irritation and ulceration. Continued suture.

FIG. 5



The continued suture as applied to the intestine.

Twisted Suture.—The twisted suture (Fig. 6), is of value in certain operations on the lips and cheeks, and in other parts where difficulty is experienced in bringing the parts together, since by its use more force can be brought to bear upon the margins of the wound, and their adaptation can thus be rendered more perfect. This form of suture was, in former times, the one commonly employed in harelip operations; but it is not so now. I have for years discarded it in favour of the interrupted suture of silkworm gut, or wire, and employ it only in cases in which exceptional difficulty is experienced in bringing the parts together. It is useful, however, in cheilo-plastic operations, as well as in the Pirogoff and Chopart's amputations. To apply it, some fine pins, with flat heads, silk, and cutting pliers, are wanted. The pins are employed to bring *the surfaces of the wound in contact*, and their points *should be introduced half an inch or more from the* margin of the wound, Twisted suture.

and passed deeply and obliquely in lip operations, through the thickness of the tissues down to, but not through, the lining mucous membrane (Fig. 6.) They should then be made to pass through the opposite side and brought out through the skin at a corresponding point. A piece of silk passed as a figure-of-8 should be twisted around the two ends. The wound may next be drawn together, and should the apposition of the surfaces be imperfect, the pins should be taken out, and the parts be re-adjusted, and in this lies the great advantage of this form of suture. After the silk has been tied in knots, and the ends cut off, the points of the pins should be removed, and the soft parts protected from the ends, if necessary, by the introduction beneath them of a small piece of lint or strapping. Instead of silk being twisted round the pins, a section of an india-rubber tube, in the form of a ring, has been employed by Mr. Rigal and the late W. L. Atlee, of Philadelphia. The ring is slipped over the ends of the pin, and serves, by its elasticity, to keep the parts together.

FIG. 6.



The twisted suture.

Quilled suture.

Quilled Suture,—This form of suture (Fig. 7), is applicable where deep wounds have to be well held together along their whole line, and more particularly for a brief period, say two or three days. In

FIG. 7.



The quilled suture.

Its application.

ruptured perineum it used to be in general use, combined with superficial sutures; but the interrupted sutures of silkworm gut, introduced

well away from the margins of the wound, and inserted deeply, are probably to be preferred.

For the application of this suture, a strong curved needle with an eye at the end, and threaded, is to be inserted at least three-quarters of an inch from one margin of the wound, and made to pass well down to its depths, then brought out through the other margin in a corresponding line. The loop of the suture should now be caught and held, and the needle withdrawn; a piece of bougie, cut the required length, being introduced into the loop, is fixed by drawing the free ends of the ligature home (Fig. 7 A). A second or third suture can be applied in the same way. A second piece of bougie ought then to be tied on the opposite margin of the wound, the parts having been well cleansed previously, and carefully adjusted. The surfaces of the wound are only to be held closely in apposition, and must not be pressed too firmly, otherwise the bougies will set up ulceration. Superficial sutures may subsequently be introduced into the edges of the wound (Fig. 7 B).

For the quill suture good fishing gut is better than silk or wire, as it is strong, and unirritating. Before use, it should be soaked in water to make it limp; it can be readily tied or fastened with a shot. The loops of the quill suture should generally be divided on the fifth or sixth day, but depends on the amount of irritation caused by the bougie.

FIG. 8.



Button suture.

Button suture.

The **Button Suture**, as a variety of the quill, is useful in some amputations, as the thigh, where the Surgeon is desirous of keeping the basis of the flaps together; and in breast cases and in harelip or other lip operations (Fig. 8).

Material for Sutures.—With respect to the material used for sutures, silk, wire, silk-worm gut, prepared catgut, or horsehair, are each good in certain cases when rightly selected. When there is little tension on the sutures, silk or wire may be indifferently employed, the amount of irritation exerted by one or the other material depending more upon tension than on any other condition. I have long proved this to my own satisfaction, by testing both forms of suture in the same subject, through a long series of cases.

Silkworm gut sutures in plastic operations.

In *plastic* operations, silkworm gut, well softened in water before use, is to be recommended; it holds well, and seems to irritate far less than any other material. In cases of ruptured perineum and in operations for vaginal fistula and fissured palate it should always be used. In the latter class of cases, where the soft palate alone is involved, horsehair is good, but it is not strong enough to resist much tension.

In plastic operations in which some skill may be called for in adjusting the parts, wire sutures may be selected, since they can be twisted and untwisted with facility, and the Surgeon can consequently readjust the margins of the wound as required to his satisfaction.

Catgut, when to be used.

Prepared catgut is not a reliable material for sutures, since it is uncertain as to its retaining power, and is apt when sodden to yield;

it is, however, useful as a suture in holding parts together for a brief period, where there is no tension, and where there may be a difficulty in removing the stitches subsequently. In operations on the penis, it is of special value.

Value of Pressure.—The effectual carrying out of the third indication in the treatment of incised wounds, viz. the coaptation of the two divided surfaces of the wound—deep parts as well as edges—is not, however, always to be accomplished by means of sutures and strapping, however well selected and applied these may be. Other means are constantly demanded, and of these well-directed *pressure* is the most important, as ably advocated by Gamgee; indeed, the value of pressure in the treatment of all wounds is worthy of more consideration than it has received. By it the surfaces of divided parts are kept together, and particularly the deeper surfaces; mobility of the injured tissues is checked, if not prevented; the vessels of the wounded parts are supported; and the evil influence of blood-stasis, with its effect—effusion—is neutralised. Under these circumstances repair is helped, and nature's processes are permitted to go on under more favorable conditions. With this view of the value of pressure, well applied pads of lint, absorbent cotton wool, gauze, or sponge, saturated or not with some antiseptic drug, should be carefully adjusted over the flaps of all wounds, when such exist, and over the surfaces of others. These pads are kept in position by means of strapping or bandages, aided by splints when the extremities are involved. After the removal of a breast or tumour, the value of a well-adjusted pad, and more particularly of sponge, wrung out of iodine or carbolic water, cannot be too highly praised. After an amputation, the use of a splint, adjusted to the stump, and pressure well applied to the bases of the flaps, not to the edges, should never be omitted.

Value of pressure.

Of splints.

Fourth Indication.

The Maintenance of Wounded Parts in such a position of Immobility as may be favourable to the Natural Process of Repair and Comfortable to the Patient, is the fourth indication in the treatment of incised wounds; and, to say the least, this is as important as the preceding indication, since, if neglected, the benefit that might be expected from efficiently coapting the wound could not be realised, and the process of repair in the wounded part would of necessity be checked, if not altogether prevented.

Immobility of parts.

To carry out this indication, *immobility* of the wounded part is of the first importance, and its *position* next. The position is always selected with the object of giving ease to the patient, and of preventing pain; of relaxing the wounded tissues, and so guarding against any tendency to bring about a separation of the edges of the wound, as in cut-throat cases; and last, but not least, of encouraging the return of the venous blood from the wounded parts towards the heart. Thus, in wounds of the trunk, the horizontal position is the right one to be maintained, and in those of the extremities, flexion and elevation of the limb; in wounds of the lower extremity, the foot should be kept higher than the knee, and the knee than the hip; and in those of the upper extremity, the same principles of practice should be followed, the elbow being generally flexed. Under all circumstances,

Position.

wounded limbs should be fixed upon splints, with the view of immobilising them, and, as a rule, they should be swung. This practice adds greatly to the comfort of the patients, by allowing them to move their trunks without their wounded extremities, and without, therefore, interfering with repair. It should be added, however, that the question of position ought always to be considered in reference to the *fifth* indication, namely, the necessity of providing efficient means for the removal of the superfluous fluids of the part, and for the escape of disintegrated dead tissue which may have to be discharged, or in other words for *drainage*.

Fifth Indication—Drainage.

Necessity of drainage.

Drainage, or the making of due provision for the escape from the wound of disintegrated dead tissue, with such fluids as are not required for repair, and which, if left, might prove injurious, is of primary importance in the treatment of all, and more particularly of deep wounds. It should never escape the attention of the Surgeon. In scalp wounds, and those about the eyelids—though they may appear trivial—it is of as much importance as it is in the wounds that involve deeper parts, and seem more severe; for in the one case, as in the other, pent up fluids not only separate tissues which are intended to unite, give rise to pain by producing tension, and consequently cause constitutional irritation, but they are prone to excite inflammation in the part, and ultimately to undergo septic changes, which, in their turn, may give rise to blood poisoning in the form of septicæmia or pyæmia.

No other than trivial wounds consequently should be completely covered in, and deep ones very rarely. Some corner, and preferably that which is the most dependent—some interval between the sutures or strips of the plaster—should always be left open for the escape of disintegrated tissues, and of superfluous fluids, such as blood or serum; and where deeper structures are involved, some conducting material, or "drainage tube," should be introduced. The best is a tube of indiarubber, perforated at intervals (as originally suggested by Chassaignac 1855), of a size varying with the cavity or wound to be drained; but in some cases a strand of carbolised catgut or horsehair, a roll of gutta-percha skin, or a piece of lint saturated with carbolic or terebene oil, will do as well. In abdominal cases, as after ovariotomy, a perforated glass tube is of great value, while under other circumstances an elastic catheter will answer the purpose. The particular mode of accomplishing the object is of little importance, so long as the object itself is secured.

Drainage tube.

In using a drainage tube, however, the Surgeon must remember that it is not to be made a seton, and that the sole justification for its use is to drain the fluids from the deep tissues. For this purpose the tube is to be made to dip deeply enough into the wound, but no more; it is not to be made a cause of irritation. The size of the tube is to be regulated by the requirements of the case; several short tubes are often better than a long one. Care is also to be taken that the outer ends of the tubes are left free; when covered, they should be covered but lightly, and then with some absorbent

Caution in use of drainage tube.

cotton, oakum, sponge, or gauze. As a rule, however, they should be left open.

Position of tube.

In using the tube, when the end is cut off level with the wound, the outer extremity should be held by means of loops of carbolised silk, perforating its walls, and secured externally by strapping, or other means. The tubes should always be introduced at what will be the most dependent part of the wound, when the patient is in the recumbent position; and they should be taken away as soon as they have answered their purpose. When quick or primary union has taken place, they may safely be removed at the end of twenty-four or forty-eight hours; but when suppuration is present, they must be left longer, sometimes even till the cavity has nearly closed. A drainage tube should, however, be shortened as rapidly as the progress of the case will allow, the shortening of the tube and the closing of the cavity of the wound from below going on together.

It is to be noted that, at the present day, the use of drainage, whether by tubes or other material, is suggested with the view of *preventing* suppuration in the treatment of deep wounds; whereas in former times, when Chassaignac introduced his tubes, it was for the treatment of wounds and cavities in which suppuration already existed.

The value of the principle is, however, equally great in both classes of cases. When carbolic acid is used as a wound dressing, whether as a spray or as a lotion, or when chloride of zinc lotion is employed, the use of the drainage tube is more necessary than it is when other forms of dressing are employed, since under the stimulating influences of these drugs, there is, as Lister tells us, more effusions of plasma than is to be looked for under other circumstances.

Caution in the closure of wounds.

Whenever a wound is closed, with the view either of obtaining rapid or primary union, or of converting an open, as far as possible, into a subcutaneous wound, the most careful inspection is called for, to guard against and even to anticipate trouble. In these cases, the wound should be opened on the slightest approach of local tension or over action, with elevation of temperature and traumatic fever; since such local and constitutional disturbance will probably be found to be due to the retention of some of the fluids of the part that are in excess of what is wanted for repair, and can be relieved only by the evacuation of such retained substances.

Sixth Indication—The Protection of the Wounds, &c.

Protection of wound.

The protection of the external wound from all such outside influences as may be prejudicial to the progress of natural repair, is the sixth and last indication for the Surgeon to follow; and it is in itself as important as the five which have preceded it, since it includes the use of all means by which the wound can be protected from outside injury, as well as the dressing proper or covering of the wound.

How affected.

For purposes of protection, most wounds require a covering; and when they are on the extremities or other exposed parts they also need some cradle or other mechanical appliance to keep off the weight of the bed clothes. In wounds of the face, however, coverings are rarely required, for all Surgeons are familiar with the fact that there are no wounds, opera-

tive or accidental, that do so well as these without any external application, provided that they have been carefully brought together and adjusted. Indeed, it is probably from a knowledge of these facts that the *open method* of treating wounds has been advocated. This method cannot, however, be recommended, except for wounds of the face. For some years past I have been in the habit of dressing all wounds with dry absorbent lint or with lint soaked in a mixture of terebene one part, and olive oil three parts, and have every reason to be satisfied with the practice. I simply cover the oiled lint with a second piece of dry lint, and fix the whole with a retentive bandage, room being left for drainage in all cases in which quick union is not to be expected, either by loosely covering one corner of the wound which is left open; or by perforating the lint covering the wound, to allow of the protrusion of the end of the drainage tube. Cotton wool of the absorbent kind is then arranged about the tube, to absorb all fluids that escape, but not in any way to arrest their flow; since to insert a drainage tube and then smother up its orifice, seems inconsistent practice.

Author's method of dressing wounds.

When the spray and gauze system (*Listerism*) is adopted all the precautions required for security must be observed; the principle upon which this system is based being one of exclusion, not only of air but of all germs that may be floating in it; and which are supposed to be the cause of suppuration and of the decomposition of organic fluids.

Wet applications, and more particularly watery ones, are now seldom used, and cannot be recommended, since it is well known that by moisture decomposition is encouraged. When they are employed they should be medicated; that is, they should contain some drug which has an influence in preventing or arresting decomposition, or in neutralising the evil effects of the chemical changes which are sure to take place either in the contused and devitalised tissues, or in the poured out fluids, whether blood, serum, or pus. The best of these drugs are chloride of zinc, carbolic acid, boracic acid, alcohol, terebene, thymol, iodine, the permanganate of potash, and iodoform.

Water dressings to be avoided.

On the Second Dressing of a Closed Wound.

No fixed period can be named when the first dressing should be removed from, and a second applied to, a wound which is being treated with the view of obtaining healing by "quick" or primary adhesion. But this is certain, that no interference should be allowed under a week, unless there is some indication, either in the form of local discomfort or pain, or some constitutional symptom, such as an elevation of temperature with febrile disturbance, to justify the act. In truth, to use a legal phrase, the Surgeon should, in all cases, show cause why he should interfere before he does so; for it is not to be denied that in changing dressing even with the gentlest and most skilled manipulation, there must of necessity be some interference with the reparative process; some slight tearing away of the new reparative material; some taking away of support where support is essential; or removal of local pressure where such is needed; in fact, there must always be some injurious influence upon the healing part, which should not be permitted without a compensatory good effect.

Second dressings.

A wound treated for repair by primary adhesion, if left alone, will probably, under favorable circumstances, heal within the week; and a large wound, such as that made in ovariotomy, in excision of the breast, or in amputation, will heal within two weeks under the best conditions. If it does not, it is because there is something wrong with the patient's general condition, or something wrong in the wound, or more particularly in its treatment; for the primary dressing of the wound should have been such as to render early interference with it unnecessary.

Essential points for observation in the first dressing.

To recapitulate: (1) the edges and surfaces of the wound should be carefully adjusted and fixed together; (2) complete immobility of the injured part should be guaranteed by the judicious application of splints, pads, and bandages; (3) the limb or wounded part should be placed in the most comfortable position for the patient, as well as in that which is most favorable for repair; (4) due provision should be made for the effectual drainage of the wound, and care should be taken that the effect of drainage is not neutralised by any external application or dressing; and lastly (5), such dressings or external coverings should be employed as will protect the wound from external injury, and guard against or neutralise the decomposition of such fluids as may be poured out.

A wound, however large, dressed *effectually* on these principles, will probably not require dressing for a week, or will not need more than the removal of the absorbent material which has been placed to catch the secretion which has drained away from the wound; and will be found, when dressed, to be well or nearly well. A wound, however small, dressed ineffectually, will probably be unhealed and suppurating.

The nearer the Surgeon can approach perfection in his first dressing, the more successful will he be in his practice, and the larger will be his proportion of cures by primary adhesion.

Materials required.

When a *second* dressing is called for, the Surgeon should have at hand everything which may be required for the purpose; lint, prepared in size and shape, and steeped in whatever dressing he may have arranged to use; scissors, forceps, bandages, strapping, absorbent cotton, trays, and irrigators, whether in the shape of a can or in that of a dressing-bottle (Fig. 3, p. 23)

Removal of dressings.

When the wound is large, and water is to be used in quantities, he should have a piece of waterproofing to place beneath the part or patient, and such assistants as may be required. He is then to remove the external dressings, and in doing this, as in every subsequent procedure, he is to employ the utmost gentleness. He should, however, beforehand place his patient in the most comfortable position he can, and then place himself comfortably, for no Surgeon can do his work well if he is in a constrained posture.

In removing external dressings, some time is often required, but it must be granted; for when dressings are glued to a wound by blood or secretion, they must be softened with water, or rather medicated water, before they can be taken away without doing harm. Having taken off the external dressings, rolled them up, sent them away, or thrown them into a basin of antiseptic fluid; and having exposed the wound with its sutures, and the strapping which possibly was applied for adjusting purposes, the Surgeon is then to cleanse the part, and for this object he cannot do better than use the absorbent cotton, either

of the surrounding subcutaneous or other tissue, or margins or flaps of the wound is to be expected.

In the *contused* wound the breach of surface is brought about by a blunt instrument, moving with a greater or less velocity; and the extent of bruising or contusion of the soft parts in the neighbourhood of the wound will be found to vary with the size of the instrument which inflicted the injury, and with the force of its impact. When the missile is large, the extent of injury will be proportionate; and when the velocity is great, the area of contusion around the edges of the wound will be lessened, as the extent of wound will be increased.

The most typical examples of contused wounds of all kinds are met with in military practice, and are caused by the impact of spent balls or fragments of shell.

Lacerated wounds are generally brought about by a tearing or biting process, and are characterised by great irregularity of the lacerated tissues from the skin downwards; this irregularity depends much upon the different degrees of elasticity of the parts torn—skin, arteries, muscles, and tendons all behaving differently when submitted to a lacerating force.

In *contused* wounds the area of injury generally extends far beyond the area of the breach of surface, and when death of tissue follows, it may spread widely. In *lacerated* wounds the area of injury is generally more localised; though this remark is not applicable to wounds in which muscles and tendons are involved. When, for instance, a finger or thumb is torn off, the tendons connected with the injured part may separate at their muscular origins in the forearm.

Hæmorrhage. **Hæmorrhage.**—In both contused and lacerated wounds there is less primary hæmorrhage than there is in those of the incised variety; the *contusing* force so affects the vessels at the seat of injury as to favour the coagulation of the blood about their open mouths, or so ruptures the inner and middle coats of the bruised vessels as to mechanically interfere with the flow of blood, and thus encourage the formation of a clot by which the lumen of the injured artery may become occluded; the *lacerating* force likewise irregularly divides the different coats of the vessel and its sheath—even in the case of a large artery—and thus favours the coagulation of the blood at the seat of laceration. This temporary plug of the vessels is generally sufficient to close the orifice until nature's permanent hæmostatic processes have had time to act and to seal the vessel (*vide* Chapter X).

Secondary hæmorrhage. *Secondary hæmorrhage.*—In contused wounds there is a far greater proneness to secondary hæmorrhage than is met with in any other form of wound; the contusing force often primarily injuring, but not opening an artery, yet so destroying the vitality of its coats as to excite an inflammatory, sloughing, or ulcerating process, which in its turn may open the vessel, and give rise to secondary hæmorrhage. Contused wounds are for this reason of a more dangerous character than lacerated wounds.

Subcutaneous injuries. **Subcutaneous Contused Wounds,** that is, severe contusions of soft parts without breach of surface or exposure of the injured tissue from either the impact of blunt instruments, the passage of a wheel over the part or other force, are at times more grave than those in which a breach of surface exists. The gravity of these cases is best seen by studying the

effects of such kinds of injury upon the abdominal and pelvic viscera; an unbroken and apparently uninjured outside surface often covering a fatal subcutaneous rupture of a solid viscus, or a laceration of a hollow one. The same fact may be also well seen in severe injuries to extremities, where from a contusing force, an artery may be stretched, bruised, or lacerated, large veins may be torn across, nerves injured, and muscular and other tissues irreparably damaged. The amount of harm which deep tissues may have sustained in any given injury, can therefore only be estimated by a correct appreciation of the force which has been applied, and of the position and condition of the injured part at the time of the reception of the injury. It can never be made out by simple inspection of outside appearances. Such injuries always demand great care in their treatment.

Treatment of Contused, Lacerated, and other Wounds which heal by Granulation.

Treatment of contused wounds.

The principles upon which the treatment of contused, lacerated, or open wounds is based, are the same as have been laid down and explained in considering the treatment of incised wounds, though they may require some modifications in their application, on account of the altered circumstances in which they have to be carried out. For example, in a deep *lacerated* wound the Surgeon will have to cleanse it and arrest bleeding, as in an *incised* wound; but he will not have to adjust the divided surfaces and apply sutures, in the same careful way that he would be called upon to do if a "quick union" was to be looked and worked for. He will remember that this change of practice is demanded in contused and lacerated wounds because there must of necessity be more or less sloughing or molecular disintegration of the lacerated tissue and contused parts around, and that, as a consequence, it becomes a matter of primary importance to leave the wound open for the free discharge of all such tissues as may have been destroyed, or may die, as well as for the evacuation of the fluids which must be poured out in the reparative process.

He will, however, in this class of cases as in the former, secure immobility of the wounded part, and fix it in the position which will be easiest to the patient and most conducive to the healing; and he will not forget to make the fullest provision for the drainage of the wound from its lowest depths. He will, moreover, have to be additionally careful in the dressing of the wound, since it is an open one, because from such, septic matter is more rapidly absorbed before the process of granulation has commenced, and when it has commenced such a wound is readily influenced by external applications.

In *one* instance, the wound may have to be regarded and treated as an open one from the first, the excavated surface being filled in with a light dressing, as if it were a surface wound. In *another*, where there is a tendency for the surface edges to fall together and unite, and where this union would be injurious, by interfering with the free evacuation of such discharges as are to be looked for from the wound, or with the escape of sloughs of destroyed tissue, the dressing may have to be inserted between the lips of the wound, or even down to its bottom; for it is essential, in these cases, that the wound should not be closed, and that a free vent for all fluids should be maintained; whilst in a *third* case the provision for free drainage may, from the position

of the wound, be so imperfect that a special opening (counter opening) may be called for at the most dependent situation of the injured parts, or at some other position which the ingenuity of the Surgeon may suggest. Under all circumstances, wounds such as these, which are not expected to heal by quick union, should be so dressed as to allow of the free egress of all secretions without disturbing the parts.

Dressing advised.

The primary dressing which I am in the habit of employing for fresh wounds is, as already mentioned, lint or absorbent cotton, saturated with a mixture of terebene one part, and olive oil three parts, the saturated dressing being covered with another layer of dry lint or cotton. Where a wound has to be lightly filled with some dressing, I use the absorbent cotton semi-saturated with the same terebene and oil mixture, and a light pad of the absorbent cotton applied over the whole, and held in position by a retentive bandage; and even when a drainage tube or drain orifice exists, the same light dressing is useful to absorb such fluids as may escape externally. In some cases, a soft sponge which has been wrung out of iodine or carbolic lotion is a good substitute for the wad of absorbent cotton.

Sponge pressure.

In cases of more severe wounds, where a free flow of fluid is to be expected, and where the danger of its retention would be great, the opening of the drainage tube or discharging orifice should be left free. In the dressing of all stumps and most deep incised or lacerated wounds, this practice should be followed, since it enables the Surgeon to bring the parts more accurately together than would otherwise be advisable, and to keep them quiet, and in apposition by means of pressure applied over the whole of the wound, except the drain orifice. This method has likewise the additional great advantage of allowing the Surgeon to leave the wound undisturbed for some days, probably for a week, and to postpone his first dressing till a period when nature's reparative process will have had time to shut off the wounded part from the deeper tissues, and to do much in the direction of its repair. There should always be a reason for dressing a wound; dressing as a routine practice is not to be commended; it should always be deferred till it is required.

Wounds must be kept *clean* under all circumstances, and free from every septic risk; but a wound must be kept *quiet* if repair is to go on steadily, and this quiet is as necessary for the lacerated as it is for the cleaner kinds of wound. A form of dressing, such as has been described, has advantages over many others, for it renders early and frequent dressings of the wound unnecessary.

Punctured Wounds.

Punctured wounds.

Punctured Wounds, when made with sharp-cutting instruments are deep *incised* wounds, and when with blunt or wedge-shaped tools, deep *contused* wounds. They differ from other incised and contused wounds in their depth, and in the uncertainty which, as a consequence, follows with respect to the tissues that are wounded; but above all in the difficulties which are always experienced in providing for the efficient evacuation of blood, serum, or broken-down tissue, where drainage is needed. These difficulties are clearly due to the external orifice of the wound being but small in proportion to the depth of the penetration.

When a punctured wound is made with a *clean, sharp instrument* into the healthy tissues of a healthy subject, harm need not be anticipated; indeed, quick repair may be looked for with almost as much confidence as if the wound had been of the more simple incised kind. This observation is confirmed by the general experience of all who practise subcutaneous surgery; although when large vessels or nerves are wounded troubles may arise, which are not lessened by being hidden. Varieties of.

When, however, a punctured wound is made by a *blunt and wedge-shaped* or possibly a *dirty* instrument, the wound will be of the contused kind, and being so, it will partake of the disadvantages of such wounds in addition to those which appertain to it as a punctured wound. It will consequently, being contused, be associated with death of some of the injured tissues, for the escape of which due provision will be required; and it can only be expected to heal by the second or third intention. Being a punctured wound it will, moreover, exhibit the difficulties of providing for proper drainage under circumstances in which efficient drainage is particularly called for. As a consequence of these conditions, special dangers are developed which can only be rightly met by a full recognition of their nature, and of the requirements essential to their prevention. Their special dangers.

When tense fasciæ are punctured—such as are found in the palm of the hand, sole of the foot, and scalp; or when deep muscles, bound down by fasciæ, as in the thigh, are involved, and secondary inflammation ensues, the case is often very serious. Punctured wounds of cavities are worse than those of the soft parts covering bones, in the same way that all other wounds of cavities are graver; as well as from the fact that in punctured wounds there is more uncertainty as to the nature of the parts wounded, and that with this uncertainty there are, of course, less clear indications for treatment.

Treatment of Punctured Wounds.—There is no form of wound which the Surgeon has to treat in which a greater uncertainty exists as to the results of treatment than in the punctured; and all punctured wounds should be dealt with, therefore, with the greatest caution. When the wound has been accidentally inflicted with a clean, sharp instrument, and when it is treated, as it should be, like any other clean wound, with moderate compression and the application of a dry or antiseptic dressing, such as terebene and oil, and is then left protected and at rest to heal, there will be every prospect of repair going on as satisfactorily as in wounds which Surgeons daily inflict in their operations of tenotomy and osteotomy. Even when the wound is of the contused kind, and repair by "quick union" is not to be looked for, the Surgeon is probably justified in employing the same means, although in doing so, he must be keenly alive to the risks of the case and the dangers of the practice adopted. He must be ready, on the appearance of any swelling, pain, heat, or redness, and more particularly of any elevation of temperature, to remove all dressings, expose the wound, and adopt means to give vent to the pent-up fluids of the part, and relieve the local irritation caused by their retention; by so doing he will put an end to tension of the tissues, and probably check the further absorption of substances which, if not already decomposing and undergoing Treatment of punctured wounds.

than another in which these requirements are less efficiently fulfilled.

With this standard of comparison ever prominent I will now proceed to consider the more important special modes of treating wounds.

The Treatment of Wounds by Occlusion (The Smothering System).

Treatment by occlusion.

This was, without doubt, the favourite method of dressing fresh wounds among the older Surgeons, and, in proof of this, it is only necessary to refer to the classical works of John Bell, to read how the processes of *mundifying*, *digesting*, *incarning*, and *cicatrising*, were carried out.

This method was doubtless the outcome of much observation, and was based on what was seen daily in the healing of the wounds of animals by one of the natural methods of repair—that of scabbing. "This mode of healing under a scab," "is the most natural, and, in some cases, the best of all the healing processes. Very commonly, in animals, if a wound be left wide open, the blood and other exudations from it dry on its surface, and, entangling dust and other foreign bodies, form an air-tight and adherent covering, under which scabbing takes place, and which is cast off when the healing is complete. The exact nature of the process has not been watched, but it seems to consist in little more than the formation of cuticle on the wounded surface, and it has the advantage that, as no granulations are produced, there is little or no contraction of the scar. In man the same process is less frequent; it is more apt to be spoiled by inflammation, producing exudations under the scab, which either detach it or prevent the healing of the surface beneath it. Sometimes, however, the blood shed from a wound coagulates and dries on it, and, remaining as a scab, permits healing under it; or, if this does not happen, a similarly effective scab may be formed by the serous fluid or lymph by which the surface of an exposed wound usually becomes glazed; or, more rarely, the pus of a granulating wound may scab, and sound healing take place beneath it."

Paget, Holmes' 'Syst. of Surg,' 2nd ed., vol. i, pp. 636-43.

Healing by scabbing.

"To obtain healing under a scab, if the wound be recent, the blood and exuded fluids, or if it be granulating, the pus, should be left exposed to the air till it dries on the wound, adhering to the edges and surface, and *completely excluding them from the air.*"

"There seems, however, to be a proneness to inflammation which makes the healing under a scab precarious, and less generally attainable than one could wish it. No morbid exudation should take place under a scab once formed; everything of the kind painfully compresses the wound, and retards its healing."

Such is the mechanism of healing under a scab, and such are some of the methods by which it can be brought about. In Sir A. Cooper's time (1820-40), with the same object, wounds were often sealed with lint or other material saturated with blood, and in more recent days they have been covered with collodion alone, or applied on linen; with colloid styptic; with tannin, in powder; with dry earth, or peat; with Peruvian, or Friar's balsam; with cotton wool, medicated or otherwise. In some country districts coal-tar is used for the same purpose, and with

the same view. Chassaignac's arrangement by which a wound was hermetically sealed from the air by consecutive layers of plaster, covered in with charpie or cotton wool, has also been employed. The object of each variety of this form of dressing is the same, viz. *the complete occlusion of atmospheric air*, and in each an attempt is made to place an open wound as much as possible in the position of one which is closed or subcutaneous.

In recent times this method has attracted much attention under the form of the "Cotton dressing," which was introduced in 1853 by Burggraeve, of Ghent, and advocated by Ravoth. In their hands, it was carried out, by the immediate application of splints, thickly padded with cotton wool, to the wound and injured limb, and by not interfering with the injured part for four or six days. If there was at the end of that time neither inflammation nor suppuration, but a firm scab, the wound was let alone, and only the surrounding wool was removed. If suppuration was present, the wound was dressed with cerate. This method has been described by Schultes as the methodical application of so called healing by scabbing extended to large wounds. Cotton dressing

Dr. Gräf uses cotton wool and tannin, the latter being spread over the wound in a layer as thick as the back of a knife; he leaves the dressing untouched from four to fourteen days. He and Fleck, of Dresden regard tannin as a simple and cheap antiseptic and disinfectant, and as an unirritating hæmostatic. Both Surgeons advocate this method of treating wounds in military surgery. Alphonse Guérin uses cotton wool with the view of filtering the air from germs before it reaches the wounded surface, and he applies the wool by smothering the wounded part or limb with many layers, and leaving it undisturbed for twenty-four or thirty days, unless some extraordinary complication should arise—for the detection of which a close watch is always kept—to induce him to remove it. Before he applies the dressing, he washes the wound with camphorated alcohol or carbolic acid, and in an amputation, introduces the wool between the flaps. When the dressing is removed, there is generally a healthy granulating surface, with a little sweet pus covering it, and the granulations, in the case of a stump, have probably driven out the cotton wool. This method has the advantage of giving rest to the wounded parts; the gentle and elastic pressure exerted by the wool is also beneficial; as is likewise the constant temperature maintained, and the freedom from pain, which is the result of these conditions.

Ollier employs the same dressing as Guérin, but he, in addition, sprinkles the wadding with carbolic acid. According to either plan the dressing is a close one, and is based on occlusion of the part from air, with antiseptic precautions.

SUMMARY.—If we bring this method of treating wounds by "occlusion" to the test laid down at the commencement of this section, it will be found that it fairly well fulfils three out of the last four essential principles of practice, but fails entirely in the most important—the fifth—that of drainage. That is to say, excepting in A. Guerin's practice, it includes the careful adaptation of the surfaces of the wound; insures rest and immobility of the part for some days; and provides for the protection of the wound from outside influences, and for antisepsis, but it fails entirely in making the smallest provision for "drainage;" Author's estimation of method.

'Lancet,' March 31st, 1855.

so that, as Syme cleverly expressed it, "There can be little difficulty in perceiving why the scaling-up of wounds should be the most certain means of keeping them open."

Its advantages and disadvantages.

Under these circumstances, the conclusion is clear that, whilst this may be a safe and wise practice to adopt in small or superficial wounds, it is a risky and somewhat dangerous method to follow in the treatment of those which are deep and complicated, unless very closely watched. It should never be employed in any case in which the wound is more than superficial, unless the probability of the part healing by immediate union can with good confidence be maintained; and it should never be employed at all, unless the Surgeon, carefully watching the temperature of the patient, and the local and general symptoms of the case, is prepared to at once expose the wound, if necessary, and to evacuate any pent up fluid that may be present. For my own part, whenever I seal a wound with the hope of securing a good result by allowing the parts to heal quickly, as in a subcutaneous or closed wound, I never do more than seal it with lint soaked with blood or Friar's balsam, and I take good care to have the parts otherwise well exposed to observation, in order that I may, if warned by the appearance of any local symptom, such as swelling, heat, or pain, or of any general symptom, such as increase of temperature, or fever, remove the scab, real or artificial, and give free vent to the pent-up fluids. I, moreover, never adopt the method for any other than a very clean and recent wound.

As a general mode of practice, this treatment by occlusion is not to be advocated; in exceptional cases, it may be employed, but then only with extreme caution. In most deep and complicated wounds, it should be rejected. It is only applicable in the very earliest treatment of wounds.

The Open Treatment of Wounds, or Treatment by Exposure.

Open treatment.

This method was first systematically carried out by a Vienna Surgeon named Vencenz von Kern in the beginning of this century, and more recently by Bartscher and Vezin in 1856, and by Burow in 1866. These German Surgeons were led to adopt this mode of treatment by careful observation of the healing process in wounds, and more particularly by the bad results which followed the ordinary methods of dressing by occlusion, as then employed in continental towns, by the use of bandages, charpie, lint, &c. The system of dressing wounds, by what has been described as the "smothering method," in which no air could get in, or fluid get out, gave way to the "open method," in which the free access of air was the main end sought for, and drainage the second. The success which attended this practice was, moreover, considerable, since Bartscher and Vezin had only three deaths out of thirty amputations, and Burow three out of ninety-four. The method, nevertheless, did not make headway, and it does not seem to have been followed as a rule of practice by any Surgeon except Messrs. Teale, of Leeds; Professor Humphry, of Cambridge; Dr. R. W. Krönlein, of Zurich, and some members of the Surgical Society of Moscow.

Teale and Humphry in 1850 and 1860 ('Brit. Med. Journ.'), Krönlein in 1872, and the Moscow Surgical Society in 1877, have

Humphry, 'British Med. Journal,' Oct. 27th, 1860.

at wounds of the face commonly heal up in their whole length
tention. This is due, in great measure, to the vital qualities of
and in some degree also, I apprehend, to the fact that they
y left exposed to the air, their edges being held in contact
sutures. For some years we have adopted this plan after
ns and all, or nearly all, other operations. The integuments
l by sutures placed at intervals of about an inch, and the
well as the adjacent surface, is left quite exposed to the air;
, bandage, or dressing of any kind being placed upon it. All
ion, the galling pressure, the retention of heat, and other
nces resulting from bandages and plaster are thus avoided.
of the wound and the surrounding skin being uncovered,
n take cognisance of what is going on; and we can cut a
and there when required, can keep the part clean, or take
ures without difficulty. Forasmuch as no dressings are ap-
e are none to be removed. The suffering which used to be
the dressing of wounds after operations is got rid of. In
s I do not touch the wound, except for the purpose of re-
e sutures, from the day of the operation." We decidedly
frequent union by first intention than when we were in the
applying dressings to the wounds. "If suppuration takes
early and free vent should be afforded to the pus, by cutting
s and opening the wound; and care should be taken to keep
l clean. "Large open wounds—that is, where portions of
have been removed, so that the edges cannot be approxi-
re in our hospital (Cambridge) not unfrequently left exposed
r without any covering. A dry crust or scab forms upon
eath which cicatrisation goes on, and we find that the healing
eeds more quickly in this way than when the part is kept
l the products of the wound are continually flowing away
dressings."
in tells us, after analysing six thousand cases, that the open
as proved superior to all others, and demonstrates that the

bolic water, or its protection, by pouring over it the balsam of Peru; and C. Thiersch adds that whether the wound lies quite free, or is covered with a piece of oiled silk, or with a water compress, cold or warm, does not a appear to be of importance if only free escape of the secretions is not affected thereby; we may also, he says, add irrigation without changing the character of the dressing, as practised by Bardeleben, and the permanent water bath may also be of use. Thiersch, moreover, adds that in cases of compound fracture and gunshot injuries—since the free escape of secretions is one of the most important points in their treatment—wounds may be enlarged by incisions, abscesses opened, counter openings made, and even free openings into wounded joints, or resection practised.

The conclusions of the Moscow committee are also favourable to the practice, and may be condensed as follows:—The essential feature of treatment by *aëration*, as this committee calls it, consists in avoiding all local appliances for excluding air, and in placing wounds in conditions favourable for free and direct contact with the atmosphere. Lint and other such substances should never be used. Repair by primary union should always be sought for when possible. Catgut ligatures and metallic sutures should be employed. The advocates of this system believe that the "Lister dressings" are injurious, but that the antiseptics employed counteract the baneful effects of the coverings.

Author's estimation of method.

SUMMARY.—The results of this open treatment are evidently satisfactory, and, judged by the essential points to which attention has been directed, the open treatment of wounds may be advocated; for it includes careful adaptation of parts after arrest of all bleeding, and due provision for thorough drainage; but, on the other hand, it takes little care to guard against mobility of the wounded parts, and disregards antiseptic applications and precautions.

The neglect is, however, probably due to the justifiable impression that if drainage be provided for, there will be, in the deeper parts, no retained dead tissues or fluids to decompose or undergo chemical change; and that a free current of air upon the surface of the wound is the best guarantee against septic changes of its fluids. Indeed, Professor Humphry clearly indicated this when he described how large open wounds, by this system, heal more quickly than when the part was covered and kept moist.

Some of the advocates of this system believe the open treatment to be more adapted to wounds in which union by *secondary* adhesion is to be expected, since they assert that if an open wound be maintained in a condition of perfect freedom from all irritating causes, such as foreign bodies, dirt, and decomposing elements, granulations will form, and that suppuration is not an essential part of their formation.

For my own part, after a careful review of the whole question, I must regard the open treatment of wounds as being far superior to any other in which due provision is not made for perfect drainage; but at the same time I fail to see its advantages over some others, and more particularly over that which I adopt, in which all the advantages of the open system are secured and in which, in addition, the wounded part is effectually guarded against mobility

and external injury, while at the same time due provision is made by means of a light antiseptic dressing against the possibility of any septic changes taking place at the surface, as well as in the deeper portions of the wound.

The recent investigations of Pasteur tend greatly to support the advocacy of this open dressing, since he claims to have proved "that it is the oxygen of the air which weakens or extinguishes germ virulence." Pasteur's experiments confirm those of Dr. Downs and Mr. Blunt obtained in 1877 and those obtained by Tyndall in 1881, whereby the influence of sunlight in arresting the development of bacteria was shown. 'Acad. of Med.,' 'Lancet,' Nov. 6th, 1880.

The treatment of wounds by "*irrigation*" must be regarded as only a variety in form of the open treatment, since its essential advantage consists in the cleansing and thorough draining of the wounds of all secretions and impurities. The mode of carrying out this method will be described under the heading Water Dressing.

In gun-shot wounds of limbs and in sloughing or unhealthy stumps or wounds this mode of treatment by irrigation is very satisfactory. It has been employed at Guy's Hospital for a quarter of a century and can be recommended. Esmarch speaks highly of it in military surgery.

On Water Dressing, with and without Antiseptics in Solution.

In 1825 the late Mr. Syme published a paper in the 'Edinb. Med. and Surg. Journ,' July, in which he pointed out the evils of such old methods of dressing wounds, as those of mundifying, digesting, incarning, and cicatrising, and recommended that wounds should be lightly dressed with wet lint or other simple dressing after their edges had been adjusted and well brought together by stitches. To this Surgeon, in connection with Mr. Liston, may be probably attributed the introduction into British Surgery of the use of water dressing for wounds generally. Water dressings.

The practice was very rapidly taken hold of and adopted, every thoughtful Surgeon having recognised the evils that attended the methods in which wounds were smothered with masses of charpie, lint, or other material, and left to heal as best they could under cover of such dressing saturated with blood, serum, or pus.

The practice, moreover, was simple and cleanly, and when perfected was comfortable to the patient to whom it was applied; that is, it became so, as soon as the value of a piece of oiled silk or thin gutta-percha tissue, applied over the wet lint, was recognised; the wet lint without this addition having soon become dry, and what might have been at first a wet dressing became thus converted into a dry one.

The water dressing likewise soon took the place of poultices, for by one as by the other, warmth and moisture were applied to the wound.

In 1835, ten years after the publication of Syme's paper, M. Josse, a Hospital Surgeon of Amiens, published a book on the use of cold water in surgical dressings, and advocated its use—*first*, as a trustworthy and efficient means for the control of inflammation in parts not wounded; and *secondly*, as a dressing for wounds.

"If we had the choice," he says, referring to the treatment of the first class of cases in which there is no wound, "it might be established as a general principle that we ought to employ water by affusion with a continual stream; but the nature of the parts or of the disease may prevent this, and oblige us to recur to another method; thus, linen moistened with water, and renewed without ceasing, may to a certain Irrigation.

degree prove a substitute for the affusions; but this mode requires much attention." He subsequently describes his own method: "A
How applied. vessel, with a cock near its base, is filled with water and placed upon a narrow and high table, near the patient's bed, in such a position that it shall be about a foot and a half above the diseased limb, beneath which a cerecloth is spread, intended to guard the bed and facilitate the flow of the water, which is received in a bucket, placed near for that purpose, and into which the extremity of the cerecloth descends. The diseased part should then be placed in the most convenient position; it should be lightly covered with compresses; an additional piece of linen should surround the cock by one of its extremities, while the other is extended over the highest point of the apparatus. This is destined to prevent the water from falling with all its weight on the diseased part, and rather to disperse it over a larger surface."

I have described this method of using cold water fully, for it is one now recognised as the treatment by "irrigation," which, whether employed as cold affusion to check inflammation in injured parts, as in joints, or to keep wounds clean, is of great value.

FIG. 84.



M. Josse likewise declared "that when cold water is appied directly after the injury, before reaction has taken place, and where it can be maintained with energy proportionate to the oc-
Value of cold. casion, the phenomena of reaction will be prevented; heat, pain, and swelling will be subdued, and, consequently, sympathetic fever will not take place; but when the cold has not been applied before the development of the inflammatory symptoms, they will still be conquered by its efficient use." In these opinions most Surgeons will agree; but cold is not now often employed in the manner described, the introduction of ice and ice bags having led to the adoption of simpler and more effective methods of application. The
Leiter's metallic coil. metallic coil of Leiter, of Vienna, is, probably, the best method of applying cold. I have used it freely and like it much. It seems to embody in itself all the advantages without the disadvantages of all other known methods of refrigerating a part. It is also equally valuable for the application of heat (*vide* Fig. 84).

But however valuable, cold water compresses or bandages, hot fomentations or a warm water dressing may be as applications to parts that have been injured, bruised, or inflamed, they cannot be strongly recommended as dressings to parts in which wounds exist, for it is now a fairly well recognised fact that water, *per se*, helps better than any-

thing else to encourage, in an injured or half-dying tissue, as well as in the secretions of a wounded part, chemical and fermentative changes, by means of which septic poisons are generated, or made to flourish, and from the absorption of which blood poisoning is known to follow.

Water holding some antiseptic substance in solution, may, however, be used, the antiseptic preventing or neutralising the septic changes which the water by itself might encourage.

In wounds, therefore, that are much complicated with contusion and laceration of parts, and to which hot or cold fomentations seem applicable, these medicated water-dressings may be employed; it being left to the fancy of the Surgeon whether he shall use carbolic acid 1 in 20 of water; boracic acid 1 in 50; salicylic acid 1 in 50; thymol 1 in 1000, iodine tincture 1 in 80, or iodine liquor 1 in 160, or permanganate of potash 1 part to 50.

Value of oily dressings.

For my own part, I have for years given up using water as a dressing for wounds, whether with or without antiseptic substances, for I have found that oily solutions of the same substances have advantages over the watery preparations which render them far safer and more satisfactory. Oily antiseptic applications are without doubt the best dressings for wounds which we possess, and of these, one composed of terebene one part and olive oil three or four parts, deserves, as already mentioned, the preference.

The Dry Dressing of Wounds.

Dry dressings.

A dry dressing to a wound is to be preferred to one of which simple water forms a part, since with it the sanguineous or serous exudations are more or less absorbed and rendered inert, and the surface of the wound is kept quiet, and protected, as by a scab, from outside injurious influences; whereas, with a water dressing, the injured surface of the wound and the wound-exudations are encouraged to undergo chemical and fermentative changes, by which the risks of absorption of septic matter or poison are much increased, and the dangers of the simplest wound greatly enhanced.

Their advantages.

If the dry dressing be composed of some absorbent material, such as the absorbent cotton or lint, and impregnated with an antiseptic substance, such as boracic or salicylic acid, or iodoform, its efficacy will be increased, since the dressing, under these circumstances, may be left untouched for some days, even for a week, and the healing of the part will not, therefore, be interfered with. Repair, as a consequence, will go on with greater rapidity and certainty; the secondary wound dangers will be diminished, and the ultimate issue of the case will be rendered more satisfactory.

When a wound is *small*, and the Surgeon has no doubt as to the propriety of seeking to obtain its immediate union, the dry dressing can be recommended; for it, without doubt, helps better than any other to bring about the "quick union" which is wanted.

When the wound is *large* or *deep* the same recommendation cannot be made, and the dry dressings, if used, should only be so after every care has been taken to provide for the free drainage of the part. They should, moreover, only be employed when there is a reasonable hope of the parts healing by primary union.

When a wound is *much lacerated* or *contused*, dry dressings are not applicable, since in such no Surgeon would entertain the thoughts of repair being brought about by rapid union; and where this hope cannot

reasonably be entertained, the use of the dry dressings should be discarded. In brief, in all wounds, small or large, when repair by "quick union" may reasonably be looked for, dry dressings are applicable, due provision having been made for efficient drainage. In all lacerated, contused, or deep wounds, in which repair by granulation is to be expected, these dressings are not to be recommended.

Earth Dressings.

Earth dressings.

Earth, as a dressing for wounds, has doubtless been used by savage nations from an early period of the world's history, but it was first brought before the notice of Surgeons by Dr. Addinell Hewson, of Philadelphia, U.S., in 1872; and from his work upon the subject, it seems that he first resorted to this mode of treatment in 1869. Dr. Hewson was first led to employ the earth as a deodoriser, in a bad example of compound fracture of the leg; and, as the result in this case was good in all respects, he began to employ it as a primary dressing to wounds. The

Clay used.

earth used by Dr. Hewson was dried, yellow, ferruginous clay, which had been well sifted through a fine flour-sieve, and he claims for its use many advantages. He maintains, that it is "cool and pleasant" to the patient as a local application, and that it has a marked influence in soothing pain. In burn and in carbuncle cases this relief is very striking.

Dr. Hewson has satisfied himself that earth, besides being a deodoriser, has a marked influence in preventing putrefaction; that in no case does it provoke or aggravate inflammatory action in a wound, but that in many, it retards or arrests it; and above all, that it promotes the healing process in wounds of every description, as well as in ulcers. The way in which the clay acts as a dressing may not be clear; but it seems reasonable from the evidence adduced by Dr. Hewson and others, to conclude that it has by its powers of absorbing gases, and more particularly ammonia, a chemical action upon the part to which it is applied; and that by virtue of this action, it is "an efficient means of delaying decay and putrefaction, and of preventing fermentation in animal tissue." Besides this, it excludes air from the wounded tissues, absorbs moisture and excess of discharges, and helps in a measure to give support to wounded parts.

How to apply it.

The dressing is applied directly to the wounded or ulcerated surface by dusting over it the pulverised clay; or, in the case of a stump, by placing it upon a bed of dry clay, in a box extemporised of binder's board, and by completely covering in the whole surface by some more clay. In some cases, when the clay becomes saturated with discharge, the dressing has to be renewed daily; in others, it may be left for two or more days.

Summing up.

Upon the whole, this mode of practice has not extended far beyond the sphere occupied by its originator, and it does not seem to possess any advantages over the more cleanly and simple processes which are now at the disposal of Surgeons. Some years ago, when Dr. Hewson was in London, I was tempted to give the method a trial, but I soon gave it up, as experience was not in its favour. The dirtiness of the dressing was not compensated for by any advantage. This, however, may have been because I was unable to obtain the right kind of ferruginous clay.

Alcoholic Dressing of Wounds.

Alcoholic dressing

Hippocrates, Paracelsus, and others, employed wine as a dressing to wounds, and they did so under the idea that it dried the part, and with

the belief that a dry condition was nearer a state of health, whilst humidity was nearer that of disease. Their followers used wine in which astringents were dissolved, such as gall-nuts, oak-bark, &c. All did so, moreover, with the view of arresting bleeding. In more recent times, the alcohol dressing has been made popular by Nélaton, who used it largely, and found it of value. It may be applied in the form of simple alcohol, or, which seems preferable, in that of the camphorated spirit of wine, as originally used by Dionis. Alcoholic dressing.

The dressing is said to be a coagulant and astringent, and with such properties, to favour primary adhesion. In open wounds it is said to act as a healthy stimulant to the granulations, and as a disinfectant; thus helping repair, and guarding against septicæmic changes and other wound complications. Nélaton employed compresses saturated with alcohol, and he believed the camphorated spirit to be useful only in proportion to the alcohol it contained.

M. Chédevergne asserts "that camphorated spirit of wine is without contradiction the best disinfectant that can be found for the treatment of wounds and ulcers;" and he makes this statement after a careful investigation into the value of every known antiseptic, not excluding carbolic acid. The spirit is supposed to have the power of dissolving the pus cell, of obviating its tendency to decompose, and of closing any open vessels.

Maisonneuve bathes the raw surface of the wound with the spirit, and having brought the divided edges together, and adjusted them with sutures or adhesive plaster so placed as to allow of the free escape of discharges, envelops the whole in a bandage steeped in tincture of arnica; and at times he applies over the whole the apparatus for "pneumatic aspiration," which will be again referred to. The disinfecting and cleansing power of the spirit, applied in this manner, probably helps the draining influence of the aspirator.

Upon the whole, the alcohol dressing may be favourably regarded, whether simple alcohol or spirits of camphor be employed. It has, without doubt, a cleansing and probably a disinfecting influence on a wounded surface; while at the same time, it helps materially to arrest capillary bleeding, and that serous oozing which is so detrimental to primary union. In its use, however, the Surgeon should never be induced to forget the value of the other essential points of practice to which attention has been drawn, and particularly drainage. Summing up.

Pneumatic Aspiration or Occlusion.

Maisonneuve's method of "Pneumatic Aspiration" which he employed with some success before 1867 and J. Guérin's plan of effecting "Pneumatic Occlusion" promulgated in 1865 were practised thus; assuming an amputation of the thigh to have been just performed, and the vessels secured; the edges of the wound are brought together and held in apposition with adhesive plaster but without sutures. A hood of vulcanised india-rubber is then passed over the stump several inches—a foot if space allows—from the extremity. It is essential that the aperture of the india-rubber cap should fit the limb accurately, but the crown or lower part may hang some distance from the wound. To the centre of the crown of the india-rubber cap, is attached a tube of similar material about two or three feet long, fitted by its opposite extremity, through a metallic canula, in a rubber plug which fits into a gallon glass jar. A second metallic tube pierces the india-rubber plug, How applied.

and is connected with another vulcanised tube of convenient length attached to a brass exhausting pump. A few strokes of the piston morning and evening suffice to draw the discharges from the stump into the jar, where, in the absence of air, they accumulate without danger of decomposition; while the healing of the wound is facilitated by the accurate and immovable adaptation of its surfaces and the exclusion of air. This practice of Maisonneuve's has three main objects in view, all of which are good; 1st, to check the formation of matter; 2nd, to prevent its decomposition when formed; and 3rd, to prevent its poisonous action on the system by entrance into the circulation. It is essentially based upon the principle of "drainage," and in that point of view is valuable. In exceptional cases, and particularly in certain cases of amputation it may be employed, but as a general mode of treating stumps it does not appear to possess such advantages over simpler methods as to make up for the difficulties and expense of its employment.

Its objects.

Antiseptic Irrigation of Wounds.

Antiseptic irrigation of wounds.

The value of the antiseptic irrigation of wounds is not, at the present day, likely to be disputed by any Surgeon, and a difference of opinion is only probable as to the antiseptic which shall be used, the mode of its application, and the character of the wound to which it is applicable. Every Surgeon seeks to make and to keep his patient's wounds as clean as possible, and by means of antiseptic solutions or applications to destroy, neutralise, or guard against any and every outside or local influence that can possibly bring about or encourage chemical or fermentative changes in a wound. It is true that, within the last few years a school of Surgeons has been formed, the members of which talk of "antiseptic surgery" and claim for themselves the title of "Antiseptic Surgeons," as if it were applicable to themselves alone, or rather to such of their body as have a belief in the germ theory as a cause of most, if not all, the surgical ills to which wounded flesh is heir; who assert rather loudly and dogmatically, that "antiseptic surgery" must stand or fall with the theory upon which their practice is based; that no unbeliever in the theory is likely to carry out the practice with any probability of success, since it is only by a staunch believer in the theory that care and attention to every detail of treatment sufficient to bring about a good result is likely to be given. It is true, also, that the results claimed for this practice are great, very great, beyond all previous belief; that according to these gentlemen, operations which in former times were looked upon as dangerous, can now be undertaken with "*certainty*" of success, and that others which have hitherto been regarded as unjustifiable, are now legitimate and safe. In fact, the upholders of this theory and adopters of this practice maintain that exploratory and operative measures which have been regarded as being beyond the province of the Surgeon, may now be calmly and quietly undertaken with a "*moral certainty*" of being followed by a good result. Thus it is that our sanguine *confrères* talk of cutting into healthy joints with the "*certainty*" that no danger will follow, and declare that great operations upon the bones of the knee may be undertaken with the feeling that in so doing we do not subject the patient "to any risk whatever." That a wedge-shaped piece of bone may be taken from a deformed femur, with the confidence that so produced a compound fracture

is "perfectly safe" and "without risk;" and last, but not least, that the peritoneal cavity, under "antiseptic precautions" may be opened "*with impunity.*"

I need hardly say that much of this is bold assertion and nothing more, and that it is apparently due to the sanguine temperament which seems attached to those who pin their faith to a taking theory, and adopt the practice which is based upon it, in blind deference to the authority of its distinguished originator; for facts, calmly looked at, neither by their number nor by their weight justify these conclusions, but irresistibly suggest that an enormous superstructure has been raised by the ingenuity of its builders upon a narrow foundation, and that good results have been too hastily attributed to causes which have been but some of the factors of a work to which others equally potent for good have without doubt contributed.

Listerian enthusiasm.

Facts indeed, have been employed by our self-styled "antiseptic" friends, as legal advocates use small data which tell in their favour, to support the cause they have in hand; but not as the judge who has to weigh evidence, and, with an unbiased mind give judgment. It is only by this explanation that we can understand how the "antiseptic Surgeon," when he gets a good result, is so fond of asserting that such could not have been brought about by any other form of practice than that which he adopted; and when he is attempting an operation which may in all truth be called experimental, if not rash, maintains that he undertakes it "*under the spray*" with all confidence and with a "moral certainty" of meeting with success. We must admit, however, that surgery is now much more successful than it was twenty years ago, and that of the many factors which have brought about this result, the employment of antiseptics stands foremost; and if we are not altogether indebted to Mr. Lister for their use, we are unquestionably indebted to him for the able and persistent manner in which he has both advocated their employment and demonstrated their value. All honour, therefore, to the name of Lister for having helped, more than anyone else, to establish the value of antiseptic drugs and antiseptic precautions in the practice of surgery all over the world. Let those who smile at his theory, join with those who believe in it, in giving him this just meed of praise; and let those who do not believe in the efficacy of the "Spray" do their best to prove to those who do, that all the advantages of the "antiseptic system" can be obtained by simpler means than by its use.

Amongst these means, what must be called "antiseptic irrigation" of wounds, in my judgment stands foremost. Antiseptic irrigation means the washing of a wound with an antiseptic solution, with the view of destroying any and every germ or element that might possibly set up chemical or fermentative changes in its secretions. It is as applicable to fresh wounds, accidental or operative, as it is to the suppurative or foul, and it is as valuable as a preventive as it is as a curative means.

In my own practice, the solution employed is, as has already been mentioned, iodine water—that is a mixture of the tincture of iodine and water in the proportions of 1 part to 80, or of the liquor 1 in 160, and after operations this should be applied hot. It may be used by means of the irrigating bottle as drawn at page 23. Fig. 3, or by means of sponging. Where sponges are employed, they should be well soaked in this fluid, and subsequently, before the wound is dressed, should be

Value of hot sponges.

used to absorb all excess; for this lotion when employed warm, has more power than any other of which I know to check capillary bleeding, and to bring about that desirable "glazing" of a wounded surface, which is so valuable as a first step towards quick or rapid repair. In suppurating wounds, the same lotion cleanses better than anything else, and has the power of destroying germs of evil as well as other more vaunted germicides. For the irrigation of a chronic abscess, or sinus, it is equally to be advocated; indeed, as a purifying and antiseptic lotion for all wounds of external parts, as well as for all suppurating cavities it can be highly recommended. I have employed it for years past, as a purifying agent, but without germicidal intentions, with excellent results; and although I have seen much of the spray and carbolic acid practice, I cannot yet see that its results are better than my own. Those who prefer carbolic acid as an antiseptic, can use it in the same way, in the strength of one in 30 or 40, and thymol, boracic acid, chloride of zinc, oil of eucalyptus, or any other known antiseptic, may be similarly employed.

The essential feature of the practice consists in the thorough ablution of the wounded or diseased part with the antiseptic solution, after the arrest of all bleeding; the drying of the surface of the wound as far as possible with an antiseptic hot sponge, applied with moderate pressure; and subsequently the careful dressing of the wound with some antiseptic substance in the way that was described in an early page (Protection of Wounds).

Listerian method.

The Listerian Method of Dressing Wounds.

This method is founded on the theory that the fermentation of the discharges of wounds is due to the introduction into them from without of

> "Those viewless beings
> Whose mansion is the smallest particle
> Of the impassive atmosphere,"

now known as micro-organisms or bacteria. The practice, which is based upon the theory, is framed solely and wholly with the view of destroying those aërial enemies by means of the familiar cloud of carbolised spray (1 in 40) *before* they reach the wound, and by the carbolic solution (1 in 20) when they have alighted on or entered it. The green protective gauze, carbolised catgut, and other paraphernalia being employed with the object of guarding against the introduction of the same dangerous foes during the subsequent progress of the case.

Lister's 1st article, 1867.

This method, which at its birth was named "antiseptic," is now designated "the aseptic," but the change is not acceptable, since it contains an assumption of superiority of "the Listerian" over other forms of good antiseptic surgery, when the object of all is the prevention, exclusion, and destruction of the causes of fermentation in wounds.

The sponsors of the new term have evidently forgotten that Pasteur has proved that "it is the oxygen of the air weakens or extinguishes germs;" that Downes and Tyndall have shown that "sunlight arrests development of bacteria;" that Lister has admitted "the probability that putrefaction in wounds is due rather to the septic matter in a concentrated form than to the diffused condition in which it exists either in water or in air;" that the spray is beyond all question the least important of our antiseptics; that bacteria are unable to grow in normal serum, and can only develop in that liquid when it has been

vitiated, whether by the addition of water or by the action of small quantities of the acrid products of putrefaction;" and last, but not least, "that the tissues of a healthy living body have a power of counteracting the energies of bacteria in their vicinity and preventing their development."

H. J. Bigelow, of Harvard.

The Surgeon who adopts the method must "act as if all the particles made visible by a sunbeam were noxious, falling like snowflakes during every operation and every dressing, seeking to insinuate themselves into the wound at every crevice. His aim should be to destroy the intruders, and effectually exclude their thronging companions."

To do this the *skin of the patient* over and in the neighbourhood of the intended wound should be thoroughly washed with carbolic water (1 in 20), which must be allowed to act for some little time, because the antiseptic has to mix with the fatty matters, and to penetrate into the folds of the skin, and the micro-organisms may be peculiarly resistant. The *hands of the operator* are likewise to be cleansed with the same lotion, special care being observed with the nails, and the folds of skin about them. For the *purification of the instruments* a porcelain or tin trough is provided, and filled with the 1-20 solution, and into this the instruments to be employed should be laid for at least half an hour before the operation.

Abstracted from W. Watson Cheyne's able article in Ashhurst's 'International Encyclopædia of Surgery.'

"The *sponges* are washed in the 1-40 carbolic solution. After the operation they are rinsed in water, and then placed in a jar of 1-20 solution till required again; then the 1-20 solution is squeezed out, and the sponge, when washed in the 1-40 lotion, is ready for use. These sponges may be used for a long time, till, in fact, they wear out. In some cases they get clogged with fibrine. To get rid of this, the sponge is placed in a trough containing water, and left for some days. The fibrine putrefies, and can then be washed out readily. The sponge is then placed in a jar containing the 1-20 carbolic lotion, and is ready for use when required."

The spray.

"The *purification of the air* is effected by means of a spray of carbolic acid. The spray is produced by driving a rapid current of air through the narrow orifice of a horizontal tube, which is placed over the orifice of a more or less vertical one. The air rushing over the opening in the vertical tube, sucks the air out of that, and, if the lower end dips into a fluid, the fluid is sucked up and expelled from the narrow orifice in the form of finely divided particles or spray. At present steam sprays are employed. The fluid in the retort is 1-20 watery solution of carbolic acid, and this mixing with the steam from the boiler forms a spray of about 1-30. The spray is employed during the whole operation, till in fact the dressing has been securely applied.

'Lancet,' April 3rd, 1869.

"The operation having been performed with the precautions detailed, the *hæmorrhage must be arrested.* This is done by means of ligatures of carbolised catgut. There are two kinds of catgut which are at present employed—the carbolised catgut, which was that first introduced by Mr. Lister, and the chromic-acid gut, which lasts longer in the tissues than the former, and is more rapidly and easily prepared. All bleeding points are tied, and the ligatures cut short. There is no excuse for leaving any bleeding vessels, as the ligatures cause no trouble afterwards."

'Lancet,' February 5th, 1881.

Listerian dressings.

"With the view of excluding organisms *after the operation*, the

material usually employed is the carbolic gauze. This is ordinary tarlatan, impregnated with a mixture of 1 part of carbolic acid, 4 parts of resin, and 4 parts of paraffin. If the cotton material were merely dipped in carbolic acid or carbolic lotion, the antiseptic would very quickly volatilise or be washed out by the discharge. It is necessary, therefore, to have the antiseptic stored up so that it may last for some time. This is the purpose of the resin. Resin and carbolic acid have a much greater affinity than water and carbolic acid. Water therefore may pass over a mixture of resin and carbolic acid for a considerable time without washing out all the antiseptic. If the gauze were impregnated with resin and carbolic acid alone, it would be so sticky as to be useless, and therefore paraffin is added to it in sufficient quantities to do away with its stickiness. As the gauze at ordinary temperatures does not give off much carbolic acid, dust which falls on it is not deprived of its fermenting property, and if a piece of gauze covered with dust is applied over the orifice of a drainage tube, this dust may pass into the wound and entirely defeat the object of the whole treatment. On the other hand, the watery solution of carbolic acid acts very rapidly, and hence all that is necessary is to dip the layers of the gauze which go next the wound in the 1-40 lotion. Lest the carbolic acid should evaporate, the gauze, if it is to be kept for some time, is preserved in closely shutting tin boxes.

Gauze.

"Carbolic acid is a powerful irritant, and, applied directly to a wound, it will retard or even prevent healing. With the view of overcoming this difficulty, Mr. Lister interposes a material, impervious to carbolic acid, between the wound and the gauze dressing. This material is termed the *protective*. It is ordinary oiled silk, coated on both sides with a thick layer of copal varnish; outside this a solution of dextrine is brushed, because water runs off from the material without the dextrine, just as from a duck's back, whereas the dextrine dissolves in the lotion, and the protective is equally and perfectly moistened. This protective is cut a little larger than the wound, dipped in the lotion, and applied over it. Outside the protective we have the wet gauze, larger than the protective, and overlapping it in all directions, both together being called the "deep dressing."

Protective.

Deep dressing.

"When used as a dressing, the carbolic gauze is packed into the hollows around the wound, and then a regular dressing is applied. This consists of the gauze folded in eight layers, beneath the outer layer of which is placed a piece of mackintosh cloth, what is known as hat-lining. The object of this is to make the discharge traverse the whole of the dressing, and not pass directly through, as would be the case were the mackintosh absent. If there were no mackintosh, the discharge, always passing through one part, would wash out all the antiseptic in a very short time, and putrefaction would rapidly occur. To avoid this risk a large quantity of gauze would be necessary, and this would increase the expense of the treatment very much, whereas, by the use of the mackintosh the discharge is made to pass from the centre to the edge of the dressing, that is, through a mass of gauze equal in thickness to the distance from the centre to the edge of the dressing. The same piece of mackintosh may be used several times, till in fact it wears out. After the dressing has been removed, it is taken out, sponged with carbolic lotion, and introduced into the new dressing. Thus, though an expensive material, yet, when divided over a number

Surface dressing.

of dressings, its expense becomes very little. Expense is also saved by preserving the large pieces of gauze used in the dressings. They may be washed and re-charged with the carbolic acid mixture. These dressings should be large and should overlap the wound for a considerable distance in every direction.

"The dressing is fastened on by a bandage. This may be made of carbolic gauze, which is light, cheap, and useful in many ways. But a cheaper bandage, and one sufficiently convenient, indeed more convenient than the carbolic gauze bandage in many ways, may be made of thin muslin. As the dressing may not remain closely applied to the skin during all the movements of the patient, more especially in the neck, chest, or groins, there is a certain risk that air unacted on by the antiseptic may pass under the dressing and reach the wound, carrying active septic dust along with it. This danger is obviated by applying an elastic bandage along the edge of the dressing. This may be put sufficiently on the stretch to keep the edge of the dressing accurately in contact with the skin, without pressing injuriously or interfering with the circulation in the part. Pins are put in along the edge of the dressing, fastening the dressing and the bandages together at the important points. Safety pins are the best for the purpose, as common pins are apt to get buried and lost in the gauze." Gauze bandages. Elastic bandages.

In accidental wounds, to extirpate the germs, the wound should be washed in and out with the 1-20 carbolic lotion—a syringe being employed in a case of compound fracture or gunshot wound. "Care must be taken to have the external wound freely open, so that the injected fluid may escape readily, for otherwise there would be a danger of the fluid penetrating among the layers of the cellular tissue, and causing inflammation, or even gangrene. It is well to squeeze out all the blood clots." Listerism in accidental wounds.

During an operation, the Surgeon should have spread near him towels saturated with the 1-20 carbolic lotion, upon which to place all instruments he may be using; a basin, containing the 1-40 solution, should likewise be at hand to enable the Surgeon to purify his hands and instruments should they have been contaminated with septic dust. All instruments and sponges should be handed through the carbolic spray. During amputation.

The Surgeon should know, however, for his comfort, "that there are comparatively few particles capable of causing fermentation in ordinary air," that "where no spray is at hand, the aseptic method may still be carried out; and that the spray is the least essential part of the method as at present employed. The most essential part of the treatment is the thorough purification of everything which comes in contact with the wound. The introduction of an unpurified instrument into a wound is a much worse error, and one far more likely to be followed by bad results than the momentary deflection or cessation of the spray." Consolation.

"The dressing is always changed on the day following the operation, and afterwards the rule is, that if at the hour of the ordinary visit, discharge is found at the edge of the dressing, it is changed; if not, it is left till the next day, when the same rule is followed. The dressing is never left longer than a week unchanged. In changing the dressings, the spray is used."

If the Surgeon does not have a spray at hand for the purpose of Spray not necessary.

changing the dressings, and it is necessary to expose the wound, it is pleasant to be told "that it is well, by means of a syringe, to let a current of carbolic lotion flow over it when it is exposed."

In fact it may now be said that the Listerian mode of dressing has had its day, though the principle upon which it is based survives, and is likely to do so. The antiseptic irrigation of wounds, as considered in the previous section, is simpler and equally effectual.

Subcutaneous Wounds.

Subcutaneous surgery.

When John Hunter, in 1794, in describing injuries, divided them into those in which the injured parts do not communicate externally, as sprains, bruises, simple fractures of bones, or divisions of tendons; and those which have an external communication, as compound fractures and wounds of all kinds; and laid it down as a law, that the injuries of the first class seldom inflame, whilst those of the second commonly both inflame and suppurate; he established a principle of which "indeed it seems hardly possible to exaggerate the importance" (Paget), and laid the foundation of a branch of surgical practice now known as *subcutaneous surgery*. Why it is that extensive injuries to soft parts, when covered with skin, should undergo quiet and thorough repair, with little or no constitutional disturbance, may not be clear; but daily experience teaches us, that dislocations of large joints, fractures of bones, severe contusions and lacerations of soft parts associated with copious local hæmorrhages, and even crushes of all the subcutaneous tissues of a foot or hand, as a rule, do well, provided that they are not interfered with by meddlesome practice, but are placed in the most favourable position for natural repair to carry out its silent work; whereas the same experience tells us, with no uncertain voice, that the presence of a wound, however small, may change matters all round, and turn, an injury, which had it been subcutaneous might have been regarded as trivial, into one of a serious and complicated kind. This fact is well exemplified in the different course usually taken by a simple and a compound dislocation or fracture.

Theory of its action.

What there is in the air that makes this wide difference, is now, as it ever has been, open to argument; and whether it is the stimulating or chemical influence of the oxygen, the irritating influence of atmospheric germs, the length of time the part is exposed, rather than the mere fact of exposure, or some other cause, may be subject of dispute. In modern times, the germ theory has found much favour, and has been the fashion; and attempts have been made to assign to the presence of germs every evil influence, and to regard them as the cause of inflammation and suppuration in every open wound. But this view can hardly be sustained, for, on the one hand, even in subcutaneous injuries, in which no air can get in, inflammation and suppuration may ensue; while, on the other hand, in even severe examples of fractured ribs, complicated with emphysema over the chest, body, head, and extremities—in cases in which the whole cellular tissue of the body seems infiltrated with unfiltered air under most unfavourable circumstances—it is quite exceptional for any inflammation of the infiltrated parts to take place; indeed, I may say that I have never seen an instance in which it occurred.

As corroborative evidence, I may refer to some observations made in 1857 by Malgaigne, who, to test this question, made animals emphysematous with common unfiltered air, and then fractured their bones, divided their tendons, and opened their joints *subcutaneously*; though the parts operated upon were surrounded with air no inflammation followed. I may refer also to the experiments of Wegner ('Langenbech's Archives,' vol. xx), who injected air derived from the post-mortem room into the subcutaneous tissue of rabbits with impunity. Effects of injection of air into tissues.

For my own part, I am disposed to think it is not the mere exposure of a wounded part to the influence of air that does the harm, but its prolonged exposure; since it is certain that where wounds are sealed rapidly, after the receipt of an injury, and are thus placed much in the position of subcutaneous injuries, repair goes on silently and well. Even bad compound fractures, when sealed early from the influence of air, heal, as a rule, like subcutaneous injuries.

Repair of subcutaneous wounds.—It may be accepted as a truth, that subcutaneous wounds are repaired much in the same way as open wounds that heal by quick or primary union; that is, when the wounded hard or soft tissues are brought or kept in contact, they simply re-unite. The process of repair in both cases is a quiet physiological one, not unlike that of development and growth. The action that attends the process is just enough to bring about the required result, but no more. When it is excessive, inflammation is said to exist, and this inflammation, in subcutaneous as in open wounds, always prevents, checks, arrests, or undoes the work of repair. In truth, the less there is of inflammation in a wounded part, subcutaneous or open, the more perfect and steady is the reparative process. When inflammation takes place in the site of some subcutaneous operation, the process of repair is likely to be interfered with, if not arrested, for as Paget observes, "the more manifest are the signs of inflammation, the less is the quantity of the proper reparative material, and the slower in the end is the process of repair." Repair of subcutaneous wounds. Effects of inflammation in repair.

To Paget and W. Adams in this country, we are chiefly indebted for our knowledge of this subject, and I shall use as much as possible, Adams' description of this process as published in 1860, in his work on the 'Reparative Process of Human Tendons after Division.' His investigations have confirmed those of Paget, as well as added to our stock of knowledge. How tendons repair.

Where tendons are subcutaneously divided and drawn asunder, their repair takes place as follows:—

When such a tendon as the tendo Achillis is divided subcutaneously, the divided ends separate, in an infant for half an inch, and in an adult from one to two inches, the degree depending much upon the healthy condition of the divided muscle and the amount of movement subsequently permitted in the ankle-joint.

The reparative process begins by increased vascularity in the sheath of the tendon, which is followed by the infiltration of a blastematous material into the spaces between the fibrous elements of the sheath. This material exhibits the development of innumerable small nuclei, a few cells of large size and irregular form, with granular contents, or, perhaps, with one or more nuclei and studded with minute molecules of oil. A blastematous material, in which the *cell forms* do not develop

beyond the stage of nuclei, appears to be the proper reparative material from which new tendon is developed. This nucleated blastema soon becomes vascular, capillary vessels having been seen in it on the eighteenth day; the nuclei assume an elongated, spindle, or oat-shaped form, and are seen after the addition of acetic acid to be arranged in parallel linear series. The tissue becomes gradually more fibrillated, and at last fibrous—a solid bond of union subsequently forming between the divided extremities of the tendon. The uniting medium is tough to the touch, but to the eye presents, even for at least three years, a greyish, translucent appearance, distinguishing it at once from the glistening old tendon. This new tissue remains during life, and has little tendency to contract subsequently. Adams' observations rather led him to the conclusion, that the required portion of new tendon is to be obtained during a lengthened period of formation, that is, about two to three weeks, under the ordinary conditions of health; but, in paralytic cases as in others of feeble health, this period may be doubled.

Adams informs us also, that the divided extremities of the old tendon take no active part in the reparative process during its earlier stages, although at the later the cut ends become rounded and their structure softened. They become enlarged and exhibit a tendency to split, and thin streaks of new material similar to that already described are seen between their fibres; the ends are joined by these means. At a later period, the bulbous enlargement gradually diminishes.

When a tendon is divided a second time, there is but little separation of its ends, and this is probably due to adhesion of the new tendon to the neighbouring fibro-cellular tissue, in which fact is found an explanation of the unsatisfactory results of second operations.

Extension of uniting medium not required.

There is no reason for believing that, in the treatment of deformities by tenotomy, direct approximation and re-union of the divided extremities of the tendon must first be obtained, and that the required elongation is afterwards to be procured by gradual mechanical extension of the new connecting medium, as we would stretch a piece of india rubber.

When much blood is effused, between the divided ends of the tendon, it has to be absorbed; it acts merely as a foreign body in the part, and retards repair.

Treatment of Subcutaneous Wounds.

Treatment of subcutaneous wounds.

When rightly treated, these wounds are generally repaired readily, and, as Hunter asserted, without inflammation; but when not rightly treated, "the subcutaneous action of a wound is not of itself a sufficient protection against inflammatory complications and a clumsily-performed subcutaneous operation may be as dangerous as an open wound, sometimes even more so." (W. Adams).

In the treatment of these, as of open wounds, there are, consequently essential points of practice to be observed, in order that good results may be obtained; and they are not unlike those which have been laid down for the treatment of open wounds. That is to say, the injured parts are to be placed as far as possible in a position of ease, and in which the contact of the divided tissues is assured, when contact is called for. The parts are, moreover, to be fixed by splints, bandages,

or other dressings, in a condition of absolute immobility. The seat of injury is to be protected from all outside injurious influences, and to be supported by moderate pressure; and what is more, is to be undisturbed, in order that neither by manipulation nor movement shall repair be retarded; for a subcutaneous wound is as susceptible to injury from mechanical interference as is an open wound. In treating the wounds made by the operations of subcutaneous surgery, the same principles of practice are applicable, and they are well summed up by Adams, as follows:

Principles of practice.

The conditions requisite to render the subcutaneous operations exempt from inflammation are as follows:—1. That the knife used must be of small size; 2. That the operation must be performed quickly and readily, with decision rather than force, and with as little disturbance to the soft parts as possible; 3. That the wound must be immediately closed, and a compress and bandage applied, so as to prevent effusion and to support the part; 4. That perfect quiescence to the part be insured for three or four days, and the dressing remain undisturbed. When all these conditions are strictly observed, it matters little whether large muscles, or tendons, or ligaments are divided, or even whether the larger joints of the body are opened. From all this it is to be gathered that to the treatment of subcutaneous wounds, whether of accidental or operative origin, "position," "immobility," "pressure" to support the part, and "time" for repair to perfect itself, are the four essential requisities to be provided for.

Complications of Wounds.

Why wounds do not heal kindly.

On the well-founded assumption that a wound, when made into healthy tissues in a healthy subject, will heal by natural processes if placed in the most favorable position for repair, and *not interfered with*, it cannot well be disputed, when a wound does not heal thus kindly, that there must be some obstacle or hindrance to its natural progress; and this will doubtless be found either in the nature of the wound itself, or the mode in which it has been treated, or in the peculiarities of the subject of the wound, or the surroundings of the case.

Preventible causes.

When the hindrance is due to the "*wound itself*" or to its "*treatment*," it may be that some foreign body has been left to irritate; that the hæmorrhage which ensued "primarily" on its receipt has not been effectually arrested, and that a clot has formed between the edges of the wound; that a "recurring" bleeding has taken place within a day or so after the infliction of the wound and its first dressing, from some imperfection in the treatment of the bleeding vessels, or from excessive reaction; or that a collection of serum has been allowed to form in the depths of the injured tissues. In most of these cases, the causes of non-repair are clearly referable to a want of care or skill on the part of the Surgeon who has had the early treatment of the case, and must be set down as preventable causes. By want of care, the edges of the wound may not have been properly adjusted or kept in apposition; the injured limb may not have been made immobile, and as a result, spasmodic muscular movements and jumpings of the limb may have been excited; or an insufficient provision may have *been made for drainage*, and, as a consequence, *the wound may have been irritated* by retained secre-

convenience or distress. The dressings, likewise, should be so regulated as to give comfort. In most wounds, and after most operations, some pain will be necessarily experienced, but, as a general rule, it will subside in the course of one or two hours. To relieve this symptom, however, it is well to give opium in some of its forms, and for this purpose, after an operation in which an anæsthetic has been used, it is an excellent plan to introduce into the rectum, before the patient becomes conscious, a suppository containing from one third to one half a grain of morphia. The anodyne begins to exercise its calming influence before the effects of the anæsthetic have quite passed off, and in some instances the action of the two drugs appears to be continuous. In other cases the subcutaneous injection of a *small* dose of morphia may be resorted to, or a full dose of the same drug may be given by the mouth. Under all circumstances, the early pain after a wound or operation is to be subdued.

Value of suppositories.

Causes of persistent pain.

When the pain is persistent and continuous, after the healing process has progressed or perfected itself, some nerve complication may be suspected. It may be that some nerve branch has been included in the ligature placed around a vessel; or some nerve trunk may be so involved in the cicatrix of the wound, or so bound to bone or fascia, as to be kept continually irritated or even inflamed; or it may be that no definite cause for the pain can be made out, when the case, for want of better knowledge, is regarded as neuralgic.

When the cause of the pain can be determined this should be removed, and when no cause can be ascertained, the Surgeon may be justified in cutting down on the affected nerve and stretching it; or in subcutaneously dividing it, as suggested by Hancock. As constitutional remedies, narcotics may be given, with tonics such as quinine, iron, or arsenic.

Muscular spasms.

Muscular Spasms.—The muscular spasms or twitchings which follow wounds, and more particularly amputations, can generally be prevented by the careful application of splints and well directed pressure. They should be put down as preventable sources of distress, and should be guarded against in the early dressing of the case. Well adjusted pressure, with rest of the injured part, is the one thing to be relied upon to prevent and relieve this symptom, and it rarely fails. The judicious use of narcotics should at the same time not be neglected.

Defects in the Healing Process and Diseases of Granulation.

Defects in the healing process may show themselves in either "*deficiency*" or "*excess*" of action, or in some morbid state of the granulating wound.

Deficiency of action.

Deficiency of Action.—In the old, and in the very feeble, whether from disease or otherwise, deficiency in the reparative power is to be expected; since, for repair, a balance of reserve force at the bank of health is requisite, and, where such a balance is absent, the extra force required for healing will be deficient. Wounds in subjects such as these, consequently, simply fail to heal, or heal slowly, or in the worst way; their failure resulting from a want of either the right quantity or the right kind of nutritive supply and nerve force. In wounds in which quick union is aimed at, the parts which have been brought together will simply not unite; and they will remain together only as

ıg as they are held in position by the mechanical means employed for
e purpose.

In the young and in the middle aged, the same failure in repair is ewise at times seen in cases of harelip or other plastic operations in ich quick union is needed for success; the parts do not unite by pri- ıry adhesion, but gape and granulate, and the operations consequently il. In such patients, also, fractures sometimes fail to unite as they ght, or unite but slowly, and this may be the case even when no definite ıse for the deficiency in the reparative process can be detected. In such instances, however, there is want of power from some general local cause, which must be detected before treatment can be ration- ly or successfully applied.

Exam failur repair want o action.

In wounds, in which union by primary adhesion is looked for, the ilure may be partial or complete. When it is *complete*, the wound ıst be regarded and treated as an open one, and under these circum- ıces, the sutures should be removed, and the surface cleansed and kept an, and then stimulated by some dressing, such as carbolised oil to 40; terebene and oil 1 to 4; boracic acid lotion 1 to 10; or acic acid ointment 1 to 5; or chloral or chlorate of potassium tion 10 grains to the ounce. At the same time, the wounded part ould be placed in the most comfortable position, and in that which ll be most favourable for the process of repair. The constitutional eatment should likewise be of a tonic and stimulating character, with od, abundant, though simple, food, and with wine or spirits in suffi- ent quantity to aid digestion, and to enable the feeble heart to send contents to the nerve centres, to give them force; and to the gestive apparatus, to enable it to utilise the food, and pass on waste tter. The patient at the same time should be placed in the best gienic surroundings.

Stimulating applications.

When, however, the failure in primary adhesion is not complete, but *tial*, and when there is the smallest foundation for the hope that by ing the parts together the required repair may yet be secured, the res should be left in position, the wound cleansed with some medi- l antiseptic lotion, and, if necessary, either another suture intro- d, or some other means employed to bring and to keep the parts ogether. Even should failure follow the attempt to gain primary ion, success may crown an effort made to secure secondary ion of the granulating surfaces, or union by the third inten-

Treatment when partial union has taken place.

ere the cause of non-union is local and only temporary, these mea- will often succeed, and will turn what seemed to be a failure into a tory result. In harelip, and in most plastic operations, a rigid nce to this surgery of hope and discretion is to be highly com-

ts in the healing process from excess of action or inflammation. excess of action takes place in a wound, in which repair by adhesion is looked for, disappointment in all probability will sult; for whenever there is in a wounded part more vascular an is required for the reparative process to perfect its work, first interfered with, then stopped, and finally, the wound, held together mechanically by sutures, strapping, or band- s or opens.

Defects from over-action.

xcess of action or inflammation, attacks *an open* wound that

Effects of over-action on an open wound.

is granulating and cicatrising, repair likewise ceases; the granulations, instead of presenting a healthy, florid appearance, and secreting a bland, creamy pus, become œdematous, or glazed; what has been a granulating, becomes an ulcerating surface; and the secretion from the wound changes from pus, to a thin, serous discharge, with more or less *débris* of tissue. The thin, red, marginal line, with its cicatrising edge extending on to the granulating surface, presents a more or less extended area of vascular congestion; this being—when the action is *sthenic*—red to an extreme degree, but when *asthenic*, tending towards blue, the redness shading off in intensity towards the blue lividity of congestion. The surrounding parts, moreover, will, under these circumstances, be tense from inflammatory effusion, hot and painful when the inflammation is acute, but when this is of a lower type, they will be œdematous, boggy, less painful, because less tense and less hot. When the local inflammation is sthenic, the constitutional disturbance will coincide with it in type, and the symptoms will be those of inflammatory fever; when the local action is of a low and asthenic form, the constitutional symptoms will partake of the same nature, and will approach those of low fever.

Causes of over-action in the wound.

It is to be known, and also remembered, that the acute or *sthenic* form of inflammation, as a rule, attacks a wound when newly made, and is generally excited by some local cause; possibly from the original injury, more probably from some imperfection in its primary dressing, and most probably from the retention of some irritating fluid in the depths of the wound, from want of proper drainage. This is more likely to occur in wounds of certain parts or tissues—as in wounds of joints, wounds of large cavities, and deep punctured wounds—than in lesions of another character.

The *asthenic* form of inflammation, as a rule, attacks wounds at a more advanced period; when the first effort at natural repair has been made, and has more or less succeeded, and when it might seem as if the effort to repair the part, and the power to effect that repair were not commensurate. At any rate, in the treatment of these two forms of inflammation, when attacking wounds, it will be safe to assume that such is the fact; for while in the acute or sthenic variety, a local cause for its production should be looked for, in order that it may be remedied; in the asthenic or later kind, the recognition of the fact that the inflammation is due to a deficiency of general power, is all important.

Treatment.

The *treatment of inflammation affecting wounds.*—In the *sthenic* form of inflammation, the local and general action is to be subdued by giving free vent to pent up fluids; by the local application of ice, or of some other means of applying cold; by the local abstraction of blood; and by free purgation. In the latter purpose there is nothing better, after a good purge, than repeated small doses of a saline cathartic, such as Epsom salts. When suppuration takes place, it must be suitably dealt with.

In the *asthenic* form, general tonics, with stimulants and nutritious food are essential; locally, absolute cleanliness, the free exposure of the wound for purposes of drainage, and the constant use of such stimulating antiseptic applications as the nature of the case may suggest, with, possibly, warm medicated irrigation, should be employed. Cold, locally applied, is rarely beneficial.

Diseases of Granulations.

Granulation in healthy and unhealthy subjects.

open wound heals, or a cavity fills up with reparative
oes so by a process of granulation; and when this process
n a healthy subject, and under favorable conditions, the
present certain appearances, known as healthy. When,
same kind of repair is being effected in a feeble or
ect, or under circumstances which are not favorable for
the granulations present different appearances, these
rere, *pathological*, in contradistinction to those which are
e ordinary *physiological* process of repair is being carried
s which is very closely allied to, if not identical with, that
nt and growth.

Healthy granulations

y surface, the granulations appear as small conical masses
n tissue, covered with a thin layer of pus cells. They
it florid red colour, and are fringed at their skin border
-known thin blue line which is so indicative of healthy
." During the whole of the healing process this appear-
ained, the only visible change being the gradual diminu-
ranulating surface by the steady approach of the "thin
vards the centre. Healthy wounds undergo contraction at
om one to one and a half inches a week. In the different
f these granulations under diverse circumstances, the
f the Surgeon can rapidly read, not only every important
bodily condition of the patient, but almost every varia-
y to day, in the patient's health. I have been long in
escribing a granulating surface as a kind of weather-glass
of health, in which the Surgeon can read, in the changed
the granulations themselves, and of the "thin blue line"
n, the slightest deviations from the healthy type; for
ue that, as long as a granulating surface is healing
ference is correct that the subject of the "sore" is
equally certain, when the surface has deviated from the
that there is something wrong, either in the patient, in
, or in its treatment. Thus, in a patient who is anæmic,
ns will be pale and bloodless; and when this condition
ng standing, they will lose their small conical form, and
rse watery elevations. When there is any interference
rn of the venous blood from the granulating part, from
scase, the dependent position of the limb, or the improper
plication of bandages or other mechanical appliances,
ons will appear "congested" to variable degrees, and
d. They may be so full of venous blood as to put on
ppearance which suggested to the old authors the
Juniper ulcer," the granulations looking blue or black
When the ulcer bleeds it is generally called *hæmorr-*

Deviations from health.

Anæmic watery granulations.

Congested granulations.

Weak granulations.

reparative power is feeble, and granulations form, they
pale, watery, œdematous character, and the discharge
l not be normal pus, but a seropurulent fluid; the granu-
orm *are of a weak type, and the sore* then constitutes
y called a "weak" ulcer.

Indolent granulations.

When from some constitutional or local cause the reparative process is more deficient in force, the surface of the sore will either present a few ill-formed and feeble granulating spots, or appear smooth and apparently wanting in granulations altogether, and look to the eye not unlike the tense mucous surface of the pharynx. In other cases, in which this deficiency in force is greater, the sore may present a greenish, dirty-coloured surface, discharging an acrid or putrid substance which is clearly blood and serum mixed with the decomposing elements of dead tissue; the ill-formed granulation or granulative tissue in these cases dying superficially as soon as formed, for want of power to live and develop.

Sloughing indolent granulations.

Ulcerating granulations.

In still more extreme cases of deficiency of power, what may have been a reparative process not only ceases to be so, but becomes retrograde; what had been a *constructive*, changes into a *destructive* force, and the tissues that should have been repaired break down and undergo molecular disintegration; the sore, instead of healing, becomes an ulcer, the new tissue dying from want of vitality.

On the other hand, *excess of action* may at times affect a healing sore, and, when it does so, it affects the granulating process as much as it has been shown to do a wound in which quick union or primary adhesion is sought for. In the stage of irritation, or that in which the granulation tissue is simply over stimulated, over action shows itself in an excess of secretion from the granulating surface, in the shape of pus, and probably in some increase in the size and redness of the granulations themselves; and when this is other than a passing condition from some temporary cause, it will soon become one of inflammation.

Effects of overaction on granulation.

Of inflammation.

When inflammation attacks a granulating sore, changes will occur similar to those which have been described as taking place when it affects a healing wound. Physiologically there will be an arrest of the healing process, an arrest of secretion from the granulations, and if the action be lasting, a change from what had been a healing process to one of ulceration. The ulceration will be more or less rapid, and associated with all the local and general phenomena of inflammation, such as redness and heat of the margins of the sore, and the adjoining tissues, with pain and swelling. The degree and character of the inflammation regulate these appearances; an inflamed sore or granulating surface presents as many different aspects as there are degrees or kinds of inflammation—for inflammations must be regarded as an accidental complication of the sore, and it may attack it in any stage of its progress, or in any condition.

Excess of granulations.

At times the granulating force may be in excess, and so act as to prevent repair. The granulations sprout above and beyond the margins in which the "cutifying" action is carried out, and appear either as elevated luxuriant growths in the centre of a sore or at the orifice of a sinus, or as overhanging florid granulations at the cicatrising border. In these cases there is simply an excess of force, and this excess exhibits itself in fungous granulations.

Granulations affected by dyscrasia.

Again, a granulating wound, when of long standing, may show on its surface or in its surroundings evidence of the existence of many constitutional or specific conditions; that is to say, a chronic sore in a patient who has a syphilitic taint, may present features by which the presence

of the syphilitic poison can be recognised; and a chronic sore in a scrofulous subject will manifest conditions, which, if not special, as in the syphilitic, will be clear enough to indicate sufficient feebleness and torpidity of action to suggest the existence of some general dyscrasia.

On Inflammation.

Inflammation.

When a visible part is inflamed, there are four notable phenomena to be observed, namely:—REDNESS, HEAT, PAIN, and SWELLING and these four symptoms are all associated with, if they are not directly due to, an *active* congestion of the capillaries, with more or less blood stasis of the inflamed tissue. This hyperæmia, or congestion, is moreover, accompanied with cell changes in the seat of inflammation. There is likewise an arrest or annihilation of the functions of the part, and in the case of a wound an arrest of its repair, and later on destructive changes. Redness, and heat, are the most typical of these four symptoms, and heat is the more characteristic; increase of heat being without doubt the most important clinical local symptom of inflammation.

On redness.

The "*redness*" may be localised or diffused; of a bright red color or of a livid hue; the former tint indicating a healthy or *sthenic*, the latter (evidencing want of power) an *asthenic* inflammation. It is clearly due to the capillary injection of the part, for in the sthenic form, the circulation through the capillaries is more active than it is in the *asthenic*, in which the dusky congested livid colour suggests blood stasis.

Increased heat.

The "*increase of heat*" is probably due to the *accelerated* flow of *over-heated* blood through the hyperæmic tissues, as well as to increased activity in the tissue changes of the inflamed part; but the local heat probably is never greater than that of the blood—John Hunter's sagacious utterance on the subject 100 years ago, "that a local inflammation cannot raise the temperature of an inflamed part above the source of the circulation," being declared by Sanderson, now, to be correct both in fact and theory.

Swelling or hardness.

The "*swelling* or *hardness*" is to be explained, by the nature of the tissue involved, and the degrees of blood stasis which is attained in the tissues. The serum of the blood with its coagulable lymph passively exudes from the gorged capillaries into the connective tissue of the inflamed part, in the early stage of inflammation, when the stasis is incomplete; and the emigration of the white blood corpuscles or leucocytes or protoplasmic atoms follows when it is more so. Absolute death of the involved tissue takes place when the circulation through the capillaries is entirely stopped. The exudation from the slowly flowing blood stream of corpuscular liquid being, in the words of Sanderson, "the central phenomenon of inflammation."

Pain.

"*Pain*" is a symptom which varies much as to its character as well as to its intensity, and depends a great deal upon the amount of tension in the inflamed part. In inflammation of the bone, periosteum, or of any part bound down by an unresisting fibrous tissue, such as the coat of the testis, the sclerotic of the eye, or the socket of a tooth, the pain is intense; in rheumatism in which the fibrous structures of the joints are inflamed, it is also marked. Probably it is caused by direct

pressure on the extremities of the nerves of the stretched or tense tissue.

We thus have *redness*, *heat*, *swelling*, and *pain*, as symptoms of over-action of a part, or of what is called *inflammation*, and they, one and all, appear to be direct consequences of extreme capillary vascularity of the tissue, whether that be the result of a wound or not. The blood stream through an inflamed limb has been demonstrated by experiment to exceed the normal flow in the proportion of something like four to one. These symptoms may manifest themselves in every degree of severity, their extent depending upon the intensity of the inflammatory action and the nature of the tissues that are involved. When a loose tissue is involved, the redness will be much marked, and the swelling will probably be rapid, but the pain will certainly be slight, as the tension of the part is rarely severe. When the connective tissue situated beneath a dense fascia is the seat of inflammation, or when bone is involved, the redness may be absent and the swelling comparatively slight, since the peculiarities of the part affected prevent their being manifested; but the pain will probably be severe, for the tension of the tissues, and the pressure upon the nerves of the part, will, under such circumstances, be necessarily great.

Sanderson.

When the inflammation is *acute* or rapid, all these symptoms manifest themselves with great rapidity, and the results of the action are quickly shown; when it is slow or *chronic*, they are less clearly marked.

Associated with these local symptoms of inflammation there will always be some constitutional disturbance, which is known as *inflammatory fever*. This fever may manifest itself in all degrees of severity, its intensity depending much upon the character of the inflammation and its seat. When a local affection is *acute*, or of a *sthenic* nature, the constitutional disturbance will be severe; when *chronic* it will probably be mild; and when *asthenic* it will be marked by great depression. It may show itself, therefore, only as a slight febrile state, or it may be marked by the severest symptoms.

Inflammatory fever.

Symptoms, example, compound fracture.

"Taking, for instance, a case of severe compound fracture, without much hæmorrhage, in a person otherwise sound and strong, as a type of the affection, we find that, before twenty-four hours have elapsed from the time of injury, his general system begins to be thus affected. He feels hot, or alternately very hot and chilly. His skin and lips and mouth are dry. He passes urine in less quantity, but of a higher colour, than usual. His pulse is quickened. A sense of general disorder gains upon him. He becomes restless and intolerant of disturbance. Signs of drought increase with him. His urine becomes scantier and more coloured. His skin feels hotter to the Surgeon's hand, and his pulse, whether full or hard, is quicker and stronger than before. He craves more and more for water. His face has a flushed, anxious look. He is thoroughly uncomfortable; for the most part feeling distressingly hot, but at irregular intervals feeling touches of chilliness—sometimes even of such cold that he shivers with it. His sleep is troubled and unrefreshing; or, as night comes on, he gets delirious. His tongue, besides being dry, is furred. If his bowels act (which commonly they are inapt to do without laxatives) the excretions are morbidly offensive. Gradually these symptoms give way; in proportion as the injured limb ceases to be tense, and passes into

Simon's art: Holmes' 'System of Surgery,' 2nd edit., vol. i, p. 26.

suppuration, the skin and mouth become moist again; the excretions lose their concentrated character; the hard pulse softens, and the heart's action becomes quiet; the nervous system is no longer restless; the look of trouble passes from the countenance, and the patient can again take solid food."

Causes.

There can be little doubt that these symptoms are clearly due to an increase in the temperature of the blood, and that their severity is measured by it. This is, indeed, as Simon has so aptly expressed it, "the essential fact of inflammatory fever. It is to this fact that the familiar language of feverishness bears witness,—the thirst, the scanty urine, the heat, and the shivering, the troubled brain, the excited circulation. As the blood gets hotter and hotter, more and more do these symptoms become developed. As the blood subsequently gets cooler, so, more and more, do they decline."

Average temperature.

The average temperature of the healthy human body according to Wunderlich is 98·6° F. or 37° C., but the range between, 97 and 99, is quite consistent with health. A febrile condition arises from an increase of temperature accompanied by more or less constitutional disturbance.

Excess of temperature.

It seems from Dr. Montgomery's observations, made for Mr. Simon, that "febrile excesses of bodily temperature range perhaps to ten degrees above the normal heat of the blood; the 'crisis' of a febrile state consists in a rapid and generally continuous reduction, the 'lysis' in a slow and generally discontinuous reduction, of this abnormal temperature."

Its causes.

With respect to the causes of this greater heat of blood, it is probable that the fever originates in the tissues themselves, and is a disorder of protoplasm; the results of inquiry showing "that either continuously during the intensity of feverishness, or else more abruptly when feverishness begins to subside, there can commonly be traced in the excretions an excess, more or less considerable, of those nitrogenous, sulphurised and phosphorised products which emanate from textural and humoral waste; that this increased elimination is observed even when ingestion has been reduced to a minimum; and that febrile excretions do, therefore, as a rule, undoubtedly attest an increased devitalisation of bodily material." The febrile process is then clearly a disorder of nutrition, in which in man the exchange of nitrogen exceeds the normal expenditure by nearly three quarters, and in which there is likewise an excessive discharge of carbonic acid. The discharge of nitrogen is evidently due to the disintegration of tissue or possibly of blood. This fact explains the rapid waste of body which takes place in fever. The blood coagulates with what is generally described as a "buffy coat," and it seems highly probably that, under these circumstances, it contains more than its normal complement of fibrin. There is good reason also to believe that this "buffy coat" is due to the fact that the blood-corpuscles subside in the liquor sanguinis during coagulation, leaving the upper portion of the clot colourless. What this increase of fibrin in the blood in inflammation means is a question that remains to be decided. Some pathologists believe that the blood is excellent in proportion as it is fibriniferous; that solidifying fibrin is almost incipient tissue; that the fibrinous crust, as drawn in inflammation, is the sign of its being specially adapted to the purpose of additional growth; while Simon, with others, holds "that the blood yields more fibrin, not in proportion as

Excess of fibrin.

it is ripe and perfect, but rather in proportion to quite opposite conditions; that an increased yield of fibrin portrays not perfection, but post perfection in the blood; that it corresponds not to the rise, but to the decline of albuminous material; that the relations are not with repair, but with waste; that its significance is that of something intermediate between life and excretion; that the fibriniferousness of the blood is undiminished, probably even increased by bleeding; that it is greatly developed during starvation, during violent fatigue, during diseases essentially anæmic; that its increase, under these circumstances of exhaustion, weakness, and inanition, is to the full as great as its increase during inflammation."

"These latter views seem to be most in accord with truth and with the general chemistry of inflammatory fever. They seem to indicate that the fibriniferousness of the blood in inflammation represents action of devitalisation and decay in some albuminous material. Whether this changing material be the inflamed texture gradually dissolving itself into the blood, or be the albumen of the fevered blood itself undergoing accelerated waste, cannot in the present state of knowledge be even approximately stated." (Simon.)

The effects of Inflammation on the Tissues.

Effects of inflammation on the tissues.

More or less complete *stasis of blood* in the inflamed tissue is the first effect of inflammation; as hyperæmia with greater activity in the circulation of the part is the first symptom. With this stasis, there is a slowing of the blood stream through the dilated capillaries, with a crowding together of the white corpuscles or leucocytes along their walls, and later on a migration of these same cells from the vessels into the tissues.

Blood stasis.

When the stasis is more than transitory the red blood cells themselves may extravasate into the tissues with the leucocytes; and when the stasis is complete, death of the tissue in which the choked capillaries exist ensues, "stasis being the mechanism by which inflammation kills." (Sanderson).

Effusion.

The effusion which takes place into a tissue the seat of inflammation is clearly due to stasis. "It begins from the moment that the damaged vessels are distended with blood and the internal surfaces of the walls pressed upon by their contents," (Sanderson), and it varies with the activity, character, or specific nature of the inflammation. When the inflammation is of a healthy or *sthenic* kind, it tends towards the fibrinous variety, producing plastic infiltration of the part; when of a feeble or *asthenic* form, the serous and corpuscular elements predominate. In the former case, the soft tissues appear firm and dense, and in the latter, soft and œdematous.

Recovery by resolution.

In healthy subjects, this plastic material may be re-absorbed, and the tissue into which it had been infiltrated left perfectly sound—recovery then taking place by what is termed *resolution;* in exceptional instances the plastic material may become organised.

Other effects of inflammation.

In unhealthy subjects, or in cases of intense inflammation, in which tissue is destroyed from blood stasis, the infiltrating material, with the inflamed tissue, either undergoes destructive changes and breaks up—when what is known as "*suppuration*" takes place—or the tissue

as a whole or in part dies or "*mortifies.*" The act of *suppuration* means the formation of pus and the destruction of the inflamed tissue.

Mortification.

The death of a part from inflammation means its *mortification*; when the action is a spreading one it is called "*gangrene*" or "*sloughing phagedæna,*" and the dead part thrown off is called a "*slough.*" The death of bone is called "*necrosis,*" and the dead piece of bone a "*sequestrum.*" When a portion of tissue dies, the dead is separated from the living piece by a process known as that of "*ulceration,*" ulceration of a part meaning its molecular death. When ulceration spreads an ulcer is said to exist, when this undergoes repair it does so by *granulation.*

"Resolution," "suppuration," "ulceration," and "mortification" are the four events of inflammation.

Pus.

Pus, is the product of inflammation, and it consists of leucocytes, granules, and the *débris* of the inflamed tissue floating in serum. Cohnheim considers the leucocytes to be the sole source of purulent infiltration, and Stricker believes that the formation of pus is synonymous with disintegration of tissue, the cells of the inflamed part by the act of inflammation being made to return to their embryonic state, and the amœboid protoplasmic material of which they are composed, forming by subdivision amœboid cells. The inflamed tissues by these changes are transformed into pus corpuscles.

Its physical characters.

Pus, when seen upon the surface of a granulating wound varies with the condition of the wound; when the granulating tissue is healthy the pus will be healthy, that is it will appear as a yellowish white cream-like fluid, with a sickly smell and an alkaline reaction. Under the microscope, the cells will appear like leucocytes. When the wound is inflamed leucocytes will be present, but under changed conditions; that is, they will appear as nucleated cells, with two to five nuclei (Fig. 9) mixed with granules and the *débris* of the inflamed tissue; under

FIG. 9.



A. Pus-corpuscles (magnified 350 diameters). B. Same made transparent with acetic acid. *a*. Cell-wall. *b*. Nucleus. *c*. Nucleolus. (After LEBERT.)

other circumstances the pus may be mixed with blood. In indolent sores, where the granulating power is at a minimum, the pus cells will be few, and the serum in which they float abundant.

Living pus is composed of leucocytes and serum—liquor puris; dead

pus is made up of nucleated cells, containing from two to five nuclei, granules, and serum. The leucocytes show their amœboid movements in the living, but not in the dead, pus. All pus is soluble in alkalies, and has an alkaline reaction. Acetic acid dissolves the nucleus of a leucocyte, but renders clearer the nuclei of a dead pus cell. The pus of a chronic abscess is not only dead, but undergoing degeneration; its cells are large and full of fat cells. The fluid in which the pus cells float, likewise contains fat and granules in abundance.

Accidental elements may be found mixed with pus under exceptional conditions, such as cholesterine plates, and bone and other tissue elements; when vibrios and micrococci exist, the pus is undergoing chemical and fermentative changes.

Varieties of pus.

Pus, when thick and creamy, is known as healthy or *laudable* pus; when thin and watery, and containing ill-formed pus-cells, it is called "puriform fluid," this condition being generally indicative of want of power; when it is blood-stained it is called "sanious;" when thin and acrid "ichorous;" and when it contains flakes of curdy lymph "curdy." Pus from the interior of a bone is oily, containing, as Bransby Cooper showed, granular phosphate of lime. Pus from the brain is often green, from the liver brown; the debris of broken-down tissue in different proportions and of different kinds giving these appearances.

ABSCESS.

On abscess.

A *circumscribed* collection of pus in any tissue is called an "*abscess.*" When pus is not circumscribed but diffused in the connective tissue beneath the skin, between muscles, or along tendons, and *infiltrates* a part, *diffused suppuration* is said to exist, this latter condition always indicating want of power.

Varieties.

An abscess is always the result of an inflammatory process. When it forms rapidly, and is associated with severe local as well as constitutional symptoms, it is known as an "acute abscess;" when it is of slow formation, and the symptoms attending its progress are mild, it is called a "chronic or cold abscess;" but there are many intermediate forms. In an "acute" abscess, the pus and broken-down tissue is circumscribed by the organisation of the coagulable lymph, and the parts around are infiltrated with serum as indicated by pitting on pressure. In a "chronic" abscess, the walls are thick from the

Walls of an abscess.

organisation of the inflammatory products, whereby nature checks the extension of the disease, and forms what Surgeons of old called the "pyogenic" membrane, which is well exemplified in chronic abscess in bone.

On acute abscess.

An acute abscess is invariably preceded by the constitutional symptoms of inflammatory fever, and is accompanied by the usual local phenomena of inflammation, such as pain, redness, heat, and swelling. As the

Local signs

abscess forms, the local symptoms become intensified, and perhaps concentrated; the pain alters in character, becoming at first dull and heavy, and then throbbing; the fever symptoms also subside, or rather intermit, and a shivering fit or rigor more or less well marked, followed by heat, and possibly sweating, takes its place. The swelling, moreover, which was previously diffused becomes more localised; a soft and possibly tender spot with a surrounding area of œdema shows itself.

and the parts covering it begin to thin. With the fingers of one hand steadily kept flat upon the swelling, and those of the other made to press upon it in another part, the walls of the abscess will be made to rise against the fixed fingers, and a sense of "fluctuation" be given —this feeling of fluctuation indicating the presence of fluid, and in this particular case of pus. Under these circumstances the "pointing" of the abscess will soon take place; meaning by this, the thinning of the part covering in the abscess in the direction of least resistance, the subsequent bursting or sloughing of the skin, and the discharge of the abscess-cavity's contents. When the pus has been evacuated, the walls of the abscess, by their natural elasticity, fall together or collapse, the external wound closes, and the abscess either heals or contracts into a *sinus* or narrow canal, sometimes called a *fistula*. When the pus is *deep-seated*, or bound down by fascia or periosteum, what is called "*burrowing*" takes place; the matter makes its way between the soft parts, where the least resistance is met with, and opens either into a mucous passage, serous cavity, or joint. Abscesses beneath the periosteum constantly open into joints; those beneath the abdominal muscles or within the abdomen, into the intestinal canal; and others in the extremities may burrow beneath the muscles, and make their way to the surface a long way from the original seat of the disease. In disease of the dorsal vertebræ, an abscess may burrow beneath the abdominal fascia, extend behind the sheath of the psoas muscle, Poupart's ligament, and deep fascia of the thigh, and open on the inside or outside of the thigh; whilst in other cases it may pass into the pelvis, and out again at the sciatic notch; and appear in the buttock as a "gluteal abscess." In disease of the lumbar vertebræ an abscess may also form, burrow between the abdominal muscles, and appear in the front of the abdomen above Poupart's ligament. An abscess beneath the scalp may undermine the whole scalp tissue; one behind the fascia and muscles of the pharynx may spread so as to cause a large post-pharyngeal tumour, and cause death by suffocation; while deep-seated abscesses of the neck may burrow into the thorax, and thus produce fatal mischief. These instances serve to show how pus, when confined beneath a strong membrane, will burrow along the cellular tissue of a part to find some outlet, and how necessary it is for the Surgeon to be aware of the fact, in order that he may stop the process, or trace the cause of the disease to its source.

Fluctuation.

Pointing.

Burrowing abscess.

Examples of burrowing abscess.

The "*diagnosis*" of an acute abscess ought not to be difficult, but when the abscess is chronic the same cannot be said. Every Hospital Surgeon can record errors of diagnosis, in which chronic deep-seated abscesses have been mistaken for cancerous or sarcomatous growths and even for aneurism, and in which breasts have been removed for cancer which were the subjects of chronic abscesses. The knowledge of these past errors it is hoped will do much towards guarding against their future perpetration; but the best security is caution, and a diagnosis of the case by the process of reasoning by exclusion as laid down on page 2.

Diagnosis of abscess.

Chronic abscesses are of remarkably slow formation, and give rise to very little constitutional disturbance or local symptoms other than swelling; indeed, except mechanically, they seem to be of little annoyance, unless they are secondary to some organic disease. Even then it is astonishing to what a size a chronic abscess will sometimes attain

On chronic abscess.

before it is discovered or complained of. In spinal cases this is often verified. In children, also, large abscesses form in the same quiet way. They are, however, never met with in the robust and strong. Abscesses connected with enlarged glands are peculiarly passive in their progress, and cause pain only when they begin to make their way through the skin. Those, again, which occur in chronic joint disease when the disease seems to be undergoing recovery, show themselves in the same quiet way. Sir J. Paget has described these as "residual abscesses." They seem to be a simple breaking-down of old inflammatory products poured out in the cellular tissue during the more active period of the disease, and which had failed to be re-absorbed or to become organised, much in the same way as a scar may break down after a fever.

'Clinical Lect.' 2nd ed., 1879.

Absorption of pus.

Pus may be absorbed, the serous fluid in which the cells float being taken up, and the cells left to wither—these subsequently forming a pultaceous, and, at a later date, a cretaceous mass. Clinically, however, pus may disappear altogether, and leave no external evidence of its former existence. The fact is now clearly recognised by Surgeons, and the absorption of pus is constantly seen in the eye in hypopyon, as well as in the disappearance of periosteal enlargements and chronic subcutaneous abscesses. This result, however, can only be expected in chronic cases which are not connected with deep-seated organic mischief.

Treatment of abscess.

TREATMENT.—In all cases of acute suppuration, the abscess should be opened as soon as it has formed; and in many instances of acute local inflammation, the inflammatory fluids should be let out as soon as they have been effused, with the view of checking the inflammatory action and of guarding against the evil effects of "tension" upon the involved tissues. In acute inflammation about the thecæ of tendons of the hand and foot, or of the periosteum, this practice should be binding, since an early incision in such cases by relieving tension, often saves tissue, and cuts short disease. The abscess should be opened also where it is pointing; and the inflamed part cut into where it is most tense, and can be well drained; and this proceeding is best effected with a straight narrow bistoury, such as the pocket-case finger knife, unless the abscess be small, when a double-edged knife, such as that illustrated in Fig. 10, should be employed. The incision in both cases should be made by

Relief of tension.

Incision.

FIG. 10.



Double-edged Abscess Knife, with groove in centre (full-sized).

means of a vertical puncture into the abscess cavity, followed by a free cut outwards—the opening being large enough to allow a ready escape of all pent-up fluid, and the subsequent irrigation of the abscess cavity with some iodine or other antiseptic lotion. A piece of lint soaked in terebene or carbolic oil, or a drainage tube, should then be introduced into the abscess cavity to insure the escape of any effused fluids that may subsequently be poured out; and the parts in which the abscess exists, should be made immobile by splints and bandages. By

such treatment the abscess cavity may be expected naturally to contract, its walls to unite, and recovery to take place.

During the formation of an abscess, fomentations, poultices, and warm-water dressings give comfort, and may be used. They are only admissible, however, when suppuration and external discharge may be expected. When absorption is probable, as in certain residual or chronic abscesses, such means should not be employed, but rather absolute rest of the affected part, and an absence of all irritating applications; tonic treatment and regimen being the chief general means upon which reliance can be placed.

Use of aspirator.

To help this desirable result, it is a good practice to draw off the pus from a chronic abscess with the aspirator of Dieulafoy. I have done this on many occasions with a good result, and no re-collection has taken place, but as often as not the fluid re-accumulated, and a free incision was subsequently necessary. Whenever an abscess is opened, the incision should be free enough to admit of a ready outlet of its contents, and to prevent any re-accumulation.

Treatment of deep abscess.

Wherever burrowing suppuration in a part can be detected, the sooner an external outlet is made the better, whether that burrowing be beneath the scalp, behind the pharynx, among the deep cervical tissues, in the theca of tendons, between the layers of muscles of an extremity, or beneath the periosteum, and this is more especially requisite when the suppuration occurs about joints or beneath the deep fascia, and particularly the fasciæ of the perinæum and anus.

Superficial abscesses ought always to be opened. On the neck and face the line of incision should be made to correspond with the course of the superficial skin muscles, or the lines or folds of the part—the deformity resulting from the cicatrix being thereby greatly diminished; but in other cases the incision must be in the best direction for emptying the cavity. In all abscesses the puncture should be made where the abscess is "pointing," or the integument is thinnest; and, where this indication is absent, at the most dependant part of the abscess. The operator should always avoid dividing superficial veins and nerves, the position of the former being made out by intercepting the flow of blood through them by the pressure of the finger. Deep vessels and nerves should be carefully avoided, their anatomical position being always remembered. When abscesses have to be opened in the neighbourhood of these important structures, the incision should be made parallel to them.

Avoid deep vessels.

Mode of opening abscesses.

In opening an abscess a plunge ought not to be made. The operator should mark the point of intended puncture with his eye, then, introducing his instrument with decision through the soft parts into the cavity, make the incision of the required length by cutting outwards as soon as pus oozes upwards by the sides of the instrument. To do this sleepily is to give unnecessary pain, whereas to do it with a stab or plunge only causes unnecessary alarm. It should be done, as ought every other act of surgery, with confidence and decision; boldness and rapidity of action being governed by caution, and made subservient to safety.

To open an abscess that is pointing (or which has a cavity to be felt) by dissecting down upon it, is a *bad* practice; although in deep-seated abscesses, which are covered by parts which it would be dangerous to wound, where surgical interference is called for, such a method may

be the best—extreme caution being requisite under circumstances of extreme danger. In such cases the Surgeon should follow Mr. Hilton's method of opening deep-seated abscesses, which has been practised at Guy's for many years.

Hilton's method.

In deep-seated abscessess in the axilla, says Hilton ('Lectures on Rest,' 1863), "I cut with a lancet through the skin and cellular tissue of the axilla, about half or three-quarters of an inch behind the axillary edge of the great pectoral muscle. At this point we can meet with no blood-vessels. Then I push a groved probe, or grooved director, upwards into the swelling in the axilla; and, if you watch the groove, a little opaque serum or pus will show itself. Take a blunt (not a sharp) instrument, such as a pair of dressing forceps, and run the closed blades along the groove in the probe or director into the swelling. Now, opening the handles, you at the same time open the blades, situated within the abscess, and so tear open the abscess. Lastly, by keeping open the blades of the forceps during the withdrawal of the instrument, you leave a lacerated tract or canal communicating with the collection of pus, which will not readily unite, and will permit the easy exit of matter." In this way deep cervical and post-pharyngeal abscesses, deep abscesses of the thigh, leg and forearm, may be fearlessly opened.

After-treatment.

When an abscess has been opened it should be left to discharge by itself. Any squeezing or pressing upon the walls of the abscess is unnecessary and injurious. In some, a piece of oiled lint should be introduced between the edges of the wound to prevent their closure, more particularly when the deep fascia has been opened; whilst in others of large size, the introduction of "a drainage tube" made of a piece of india-rubber tubing perforated at intervals may be required; in all provision for drainage should be made.

Tonics and diet.

Tonics and good feeding are always essential elements in the treatment, sedatives being given only when required.

On opening chronic abscesses.

When a *chronic abscess* requires opening—a question which in every case should be well considered—a free incision should be made into its cavity, its contents evacuated, and the cavity well washed with some antiseptic lotion. For this latter purpose a mixture of one or two drachms of the tincture of iodine to each pint of tepid water is the best; a drainage tube should then be introduced, care being taken that if air enters, its exit also can be guaranteed. The abscess should be washed out daily.

Free opening.

When the Listerian method of dressing wounds is employed, the abscess cavity must be opened under the spray, drained with proper sized drainage tubes, and covered with the gauze and protective. An excellent plan likewise consists in making a free opening into the abscess, previously covered with a piece of lint soaked in carbolic oil (one part of acid to twenty of olive oil), beneath which the pus flows away; in this manner no air is admitted. In the subsequent dressings care must be taken to keep the opening surrounded with the vapour of the acid, and the lint should be removed only to be replaced by a freshly steeped piece. No pressure should be made upon the walls of the abscess for the purpose of emptying its cavity without the opening being covered with carbolic oil. I have, however, used, in several cases, olive oil alone with equally good results.

Suppurating ovarian and hydatid cysts may be treated as large ab-

scesses, and with considerable success. Empyemata or abscesses in the chest can also be dealt with on the same principle, by a free opening into the thorax and a free outlet for the pus. In these cases the drainage tube is of great value, care being necessary to drop one end of it well down to the bottom of the cavity.

Drainage tube.

The drainage tube was suggested by M. Chassaignac, and is simply a small india-rubber tube, perforated every half inch or so with holes to allow of the free escape of the pus. When large cavities are opened they should be washed out, at intervals, with an iodine lotion or other antiseptic fluid, so that nothing like decomposition, as indicated by fetor, may be allowed. With this precaution large suppurating cavities can be dealt with successfully.

Hæmorrhage into abscess cavities.

When veins and large arteries are opened, by ulceration, into abscesses —an accident of occasional occurrence—they should be treated on the principle laid down in the chapter on hæmorrhage; *i.e.*, if the bleeding vessel be large, it should be secured, when possible, at the point at which it has given way, either by ligature or torsion; and if small, the hæmorrhage can easily be arrested by pressure.

Abscesses associated with enlarged glands.

Chronic abscesses associated with glandular enlargement need not be opened under some circumstances, because with constitutional treatment they often disappear; yet they should be so treated as soon as it is clear that they will, if let alone, open by natural processes, in order to save the ugly cicatrix that takes place under these circumstances from ulceration of the skin. The Surgeon should make a small puncture in the best line to allow of the exit of the pus and to prevent disfigurement. Gentle pressure with cotton wool over the part afterwards, often hastens the recovery. In subjects of the hæmorrhagic diathesis an abscess may be opened by the cautery or canula.

Arrest of Acute Inflammation by the Obstruction of the Main Artery of the part.

On arrest of inflammation by deligation of main artery.

To arrest acute inflammation in a limb, the deligation of the main artery of the limb, or the arrest of the circulation through it by pressure upon the artery has been adopted. Dr. Campbell, of New Orleans, speaks highly of the practice, and even affirms that no portion of an extremity should be amputated for destructive inflammation without this experiment being attempted. On the suggestion of the late Mr. Maunder, of the London Hospital, Mr. Little, in 1867, applied a ligature to the femoral artery for acute suppuration of the knee, with a success sufficient to prove the value of the practice. Mr. Maunder himself afterwards had a similar successful result ("Lettsom. Lect.," 'Lancet,' 1875). The late Mr. Moore, of the Middlesex Hospital, also compressed the brachial artery with a good result. Previous to these cases, however, as early as 1813, Dr. Onderdonk, of America, ligatured the femoral in a case of wound of the knee-joint, to check acute inflammation, and others since his time have followed his practice. It is a method of treatment certainly worthy of attention, inasmuch as to cut off the supply of blood to an inflamed part, when too much is passing to it, is sound in theory; and to do the same to starve out the disease is equally scientific. In elephantiasis Arabum the practice does not seem to be without its good effects, and, in acute disease, it is certainly *admissible*.

Examples.

I well remember, as a student, observing, under the care of the late

Mr. Bransby Cooper, a serious case of compound fracture of the leg, complicated with a severe laceration of the thigh and division of the femoral artery of the same side. He was in doubt as to the practice he ought to follow, not knowing whether with the divided femoral the supply of blood would be sufficient to repair the compound fracture. The success of the case, however, proved that the fear was groundless, for repair went on uninterruptedly, and a good limb was the result. The patient was a man of middle age. In 1873 I also treated with uninterrupted success a case of compound fracture of the humerus into the elbow-joint in a man where the brachial artery was obstructed, in which recovery with a movable joint was accomplished.

On digital compression of main artery in inflammations.

With respect to the treatment of inflammation by the *digital* compression of the main arterial trunks leading to the injured or diseased parts, it must be recorded that in 1861 Dr. T. Vanzetti, of Padua, wrote a paper on the subject, which Mr. S. Gamgee has translated in his work 'On Fractures' (1871). He was led to apply this treatment to cases of inflammatory disease from its success in the treatment of aneurisms. He asserts that compression will cure every incipient inflammation, and check it even when advanced, and he adduces cases of phlegmonous erysipelas and acute arthritis of the hand successfully treated by such a process. He adds however, that "in the treatment of aneurisms as of inflammations, compression can never become a normal method until it be always and exclusively effected with the finger."

SINUS AND FISTULA.

On sinus and fistula.

A Fistula is an unnatural communication between a normal cavity or canal and the outside of the body or with a second cavity or canal.

Definition.

A Sinus is a narrow and often tortuous suppurating tract with only one orifice.

Varieties of fistula.

Amongst the *fistulæ*, there are the vesico-vaginal and the recto-vaginal fistulæ in women; the recto-vesical in men; gastric and biliary fistulæ, fæcal and anal fistulæ, salivary fistula, and urinary fistula; there are also the congenital, branchial, or umbilical fistulæ. The acquired fistulæ are either due primarily to some suppurative or ulcerative process, or to mechanical violence, operative or otherwise, and subsequently, to a want of repair. When passages are close together, the fistula in some cases may be short and direct, whilst in others it will be narrow or tortuous; the orifice of the fistula may vary much in size. When the cavity or canal is deeply placed, or the inner opening deeply situated, the fistula may be a long narrow tract. When the fistula is of *recent* origin and lined with granulations discharging pus, the walls will be soft, and will readily bleed on manipulation. When *old*, they will be smooth and hard, or "callous" and non-sensitive, and will secrete a thin, watery, non-purulent fluid. This fluid is moreover, mixed with the contents of the cavity or tract with which the fistula communicates, the discharge tending to keep the fistula open.

External orifice of fistula.

The *external* opening of a fistula or sinus presents very different appearances. It may appear as a direct or as a valvular opening, or may be depressed or raised. When leading down to a foreign body or to bone, the external orifice will be surrounded by weak granulations.

Sometimes it may scab over for a time, and then reopen by the force of the retained fluid. The *internal* opening of a fistula mostly appears as a defined orifice.

Abscess is the most common cause of *sinuses* or incomplete fistulæ; the external communication failing to close from defect in the healing power of the part; from some interference with the reparative process; from the want of a sufficiently free vent for the discharge of pus; from muscular action, which forbids that amount of rest which is required for its repair; or, lastly, from the presence of some foreign body introduced from without, or from dead bone or cretaceous inflammatory product from within. Causes of sinus.

The TREATMENT of the different forms of fistulæ is given in the chapters devoted to the special organs that are involved. In a general way, however, it may be asserted that so long as the cause of the fistula exists, repair cannot go on; so that, in "*urinary fistula*," when stricture is the cause, the stricture must be treated before the fistula. In "*anal*" fistula, when the action of the sphincter ani forbids repair, its action must be paralysed. In "*fæcal*" fistula, when obstruction to the bowel is present, the obstruction must be removed. In "*salivary*" fistula, the salivary duct must find a natural outlet before its unnatural orifice can be expected to close. When any foreign body, tooth, or dead bone, is keeping the sinus open, it must be removed. When a suppurating cavity at one end of the fistula continues to discharge, means must be taken to close it. When these objects have been achieved attention may be directed to the fistula or sinus itself, and various are the means that can be employed for their cure. Treatment of fistula. Remove cause.

Pressure in *recent* sinuses, to keep the parts in apposition, by means of pads, strapping, or bandages, is sometimes of use, the muscles that move the part being kept thereby absolutely at rest. In stumps, and after mammary abscesses, this practice is very beneficial. Pressure.

Injection of some stimulating fluid, such as the preparations of iodine (either the tincture alone or diluted with one or two parts of water) will sometimes set up a healthy action; for the same purpose a seton has been used, and of all setons the small *drainage tube* is the best, or a narrow coil of rolled gutta-percha. The *cautery* is sometimes of great use, and the galvanic is to be preferred. It can be accurately applied to the exact spot, and its heat maintained for any required time. It is generally most useful in small fistulæ. Injections. Seton. Cautery.

Laying open the sinus, is, however, as a rule, the surest plan; dividing it from end to end, and keeping the sides asunder to allow of its healing from below. In superficial sinuses, where the skin is undermined, the thin overhanging portions should be removed; and this is best done with narrow scissiors (Fig 11). When done with a knife the incision is to be made upon a grooved probe or director which has been previously introduced through the sinus. This, however, may often be done to great advantage with the wire of the galvanic cautery passed through the sinus on the grooved director, or threaded in an eyed probe; the Surgeon subsequently making traction on the two ends of the wire, made hot by contact with the battery, and dividing the tissues with a sawing motion. The division with the cautery has this advantage, that the surface of the sinus is so destroyed that it must granulate. There is consequently *less need of careful* dressing, and in old *sinuses this is a point of importance, for their* surfaces are so callous Laying open fistula. Division by cautery.

that they require to be scraped or otherwise rendered raw, to excite granulations to form.

Fig. 11.



Probe-pointed Sinus Scissors.

By ligature.

The division of a fistula with a ligature is now rarely performed, although with one of "india-rubber" it is feasible. In "bleeders" it might be called for, but in these the wire of the galvanic cautery is preferable, when it can be obtained.

Dilatation of the fistula by means of a sponge or laminaria tent is often of value.

Plastic operations for the cure of fistulæ are also means of great value, particularly of vaginal and rectal fistulæ. These will be discussed in a future chapter.

Constitutional treatment of fistula.

Last, but not least, in the treatment of sinuses and fistulæ, constitutional treatment should be employed. In the fistula following operations, such treatment is, as a rule, all that is wanted, and many are the cases in metropolitan hospitals of sinuses about stumps, skin wounds, or mammary wounds, that will heal rapidly under the influence of fresh air, good food, and tonic medicine. In all cases these means are most essential, and, with them and local treatment, success is generally to be attained.

ULCERS AND SORES.

Definition of an ulcer.

Ulceration is the result of an inflammatory process by which a *sore* or *chasm* is produced by the molecular disintegration of tissue the seat of cellular infiltration; the nutrition of the tissue being so disturbed by what is called the inflammatory process as to allow the chemical or disintegrating changes to have their way.

A sore is a chasm, a solution of continuity, caused by ulceration, the result of injury or otherwise, upon an external or internal surface of the body.

When a *sore* is being formed, or is spreading by the process of ulceration, an *ulcer* is said to exist; when the ulceration has ceased, a *sore* remains.

Varieties according to progress.

When an *ulcer* spreads rapidly it is termed "*phagedænic*;" when it spreads by gangrene, "*sloughing*;" and when with this gangrene the molecular death of the tissue, or ulceration, is combined, "*sloughing phagedæna*" is said to exist. All these processes are consequent different varieties of ulcers, and are characterised by degrees

of the process; the simple ulcer being the mildest, and the phagedænic the most severe form.

ing or cicatrising sore heals by "*granulation*" and the s the same as it is in any open wound the result of operation. It may, consequently, assume many different es, and these have been considered under the heading of f granulation, p. 67. Sores may, therefore, be *healthy, weak, indolent, sloughing from excess of indolence,* or *irrita-* which are applied to granulating sores to express their con- the time, but which have no special signification, for these es fluctuate according to the general condition of the patient cal treatment of the sore. A sore may also at any time take cerative process and spread, or may assume any of the other preading already described. Varieties according to condition of ulcer.

r may have a local or a constitutional cause.

the *local causes* of ulcers are injuries produced by blows, ome chemical or irritating application, or some skin eruption followed by inflammation and subsequent ulceration. Local causes of ulcer.

t the *constitutional* causes, *excluding cancers,* may be classed hat superinduces a low condition of the vital powers, such as , scrofula, certain habits of life, syphilis, or scurvy. Constitutional causes of ulcer.

ulcer or sore, produced from local causes, may, however, fail m some constitutional defect; and a sore which has a con- origin may be kept up by local causes—thus, a syphilitic or ulcer originating from a constitutional cause may take on characters common to the local sore. Special ulcers.

re, likewise, special ulcers, such as lupus, rodent ulcer, epithe- cinomatous ulcers, to which attention will be drawn later on.

res. as already stated, have a local origin—something exciting nation and ulceration in the skin, and a sore remaining; the ing cutaneous from the first. The ulcer fails to repair use its position is unfavorable for the process to be carried ing to some local peculiarity of the circulation of the part, aricose veins, or from some want of care in its local treat- rant of power in the patient. Ulcers of local origin.

tional sores have rarely a cutaneous origin, unless they n some ulcerating skin eruption, such as ecthyma or rupia. st always commence in the subcutaneous connective tissue as less circumscribed induration, which lasts a very variable d then softens down; the skin over it inflames, sloughs, ates, to give vent to a deeper slough; the sores or ulcers ng of a "*cellular-membranous kind.*" These ulcers may have e in an ordinary cachexia or in syphilis, but the cellulo-mem- cer is *always* constitutional, and requires *general* more than ment. In syphilis the ulcers are the result of broken-down us "gummata." The appearance of these sores will depend the period at which they are seen; but, from the time when s broken and ulcerated, the margins of the opening in the skin r thin, irregular, and undermined, and, at the bottom of the e slough will appear. When simple, the slough will appear s white, sometimes pearly; but when syphilitic, it will have of a *piece of wet washleather,* at least, in the majority of en any of the slough has come away, the skin will at first be A constitutional ulcer. Cellular-membranous.

undermined, and the margin of the sore will fall inwards, but, as the granulations rise from below, the skin will be pressed up. When the wound has cicatrised, the scar will, however, almost always be a depressed, and in syphilis, a stained one.

Around this sore several small openings often coexist, each one having formed to give exit to a small slough, the margins of which appear as if they had been punched out. These sores occur mostly about the lower part of the thigh and knee, elbow, shoulder, and forehead; they are found, however, in any part of the body. The syphilitic are always surrounded by a *dusky* kind of inflammatory border, and are rarely painful; the non-syphilitic have a pinker blush. The washleather slough and dusky margin clearly indicate the syphilitic sore.

Cellular-membranous specific ulcer.

It is by no means uncommon to discover in such a sore the specific character of a disease that had been contracted some twenty or more years previously, and that had lain dormant, after having manifested its presence by marked symptoms. Indeed, it is from the occurrence of such sores as these that the Surgeon enquires whether constitutional syphilis is really ever cured—that is, eradicated—and whether a man once syphilised, as once vaccinated, is not so permanently altered as to show under certain conditions, with comparative certainty, that he is still under the influence of the poison, and that other diseases must for ever after be modified by its existence.

Character of a healthy ulcer.

A healthy, healing, cutaneous sore is known by the small, florid, conical granulations that cover its surface, and the healthy creamy pus thrown off from it. "In granulations, new substances are formed as if the earth was taken in heaps from one place and laid in another; the *thicker and smaller the heaps* the better the granulations" (John Hunter, MS. lect., 1787). The granulations are not so vascular as to bleed, or so sensitive as to cause pain on the slightest touch. The margin is natural, and where the skin and granulations meet, a band of cicatrising tissue is to be seen, assuming, where in union with the skin, a whitish line with a fine covering of epidermis (Fig. 49B); but where in contact with the granulations a more vascular appearance than at any other part of the sore, the centre of the band being covered with a thin, purplish-blue, semi-transparent film.

By the gradual and centripetal cicatrising process of the outer border of the band, and the gradual narrowing of its circle, the sore heals.

Treatment of healthy ulcers.

Treatment.—The Surgeon's sole aim is to guard against anything that can interfere with the progress of repair. The treatment consequently is simple; a piece of absorbent lint, to protect the surface of the sore from injury, covered either with some antiseptic oily dressing, such as the terebene or carbolic oil, eucalyptol ointment, or a lotion of boracic acid, with the elevation and immobility of the part, being all that is required. The surface of the sore should be cleansed by means of a stream of tepid iodine water, or a wad of absorbent cotton wool.

Where the granulations are disposed to rise too high, dry lint may be applied, and at times a rub with lunar caustic hastens recovery. Small sores may be allowed to scab. Rest, with elevation of the limb, is always beneficial in aiding repair, but should this be impracticable, a good pure rubber bandage may be substituted, and a piece of thin sheet-lead bound over the sore outside the dressing gives efficient support and protection. In removing the dressing, care should be taken not to injure the band of delicate cicatrising tissue.

Accepting this description as that of a healing sore, deviations from this type constitute the different forms that have been described. Thus, when the granulations assume a large, pale, elevated, watery appearance, the sore is said to be "*weak*," the granulations in popular language being "proud flesh," the popular word "*proud*" being synonymous with weak. There is power in the sore to granulate, but the granulations have little power of cicatrising, they are disposed, moreover, to slough on the slightest cause. These require local stimulants, such as the nitrate of silver in stick, sulphate of zinc or copper lotion, carbolic acid lotion in the proportion of two grains to the ounce, or terebene alone or diluted with one or two parts of olive oil. Dusting the surface with powdered alum or tannin is also sometimes beneficial. Deviations from typical sore. The weak ulcer and its treatment.

The limb should be carefully elevated or bandaged, and the general health attended to.

When there is still less power in the sore, no granulations form, the surface puts on the appearance of a piece of mucous membrane, such as that of the pharynx, the sore being then called "*indolent*." At times a few weak granulations are found at one corner of its surface, but the greater part has a smooth and glassy aspect, with a thin and watery, but not purulent secretion. Where the sore has existed long, the edges will appear raised and indolent, covered with a layer of epithelium, and very senseless. It then acquires the term "*callous*"—a callous sore being an indolent one of long standing. This indolent sore is always ready to take on a sloughing action on any slight cause, such as some general derangement of the health, or the long assumption of the dependent position of the limb. It is common, indeed, to find the surface of the indolent sore "*sloughing*;" not, however, from inflammatory action, but from *extreme indolence in the granulating force*. Under these circumstances the surface of the sore becomes covered with a greenish, often fetid, secretion, the granulations as they form dying. When the sore is large, this appearance is more general towards its centre, or lowest part; and as repair goes on, the sore may cicatrise at its edges, where the granulations derive the full benefit of the vascular and nerve supply, while the centre of the sore still sloughs. In old people the margin of the sore may slough in one part and heal in another. Authors have described this indolent sore in the old as *senile ulcer*. These sores are very common and are usually found in the lower extremities, often, too, associated with varicose veins; this condition of veins has, however, little to do with their origin, although it tends much to retard their recovery. These have been described by old authors as *varicose ulcers*, simply from the fact of the two conditions being often found together. Such are almost always found in weak subjects, with a feeble circulation. The indolent and callous ulcer. May become sloughing. Senile ulcer.

The treatment of these indolent sores consists in encouraging the venous circulation of the part by its elevation, and by pressure where this cannot be secured by rest, and by local stimulants, and general tonic treatment. For pressure, there is nothing equal in value to the pure rubber bandage well applied, as recommended by H. Martin, of Massachusetts, in 1877. ('Trans. of American Med. Association.') When there is little or no action in the sore, the application of one or more blisters to the surface *is very beneficial; or blistering* liquid may be *painted over its edges. When the surface is sloughing*, half an ounce Treatment of indolent ulcers.

of carbolic acid or six ounces of terebene to a pint of olive oil, with or without the extract of opium, according to the amount of pain, forms an excellent application. Where the edges of the sore are indurated and callous, so that the cicatrisation and contraction are almost impossible, By pressure. the free scarification of the margin every half inch is often followed by a rapid change for the better; or two free incisions may be made on either side of the margin of the sore for the same purpose. During this treatment, if the venous circulation is assisted by raising the leg higher than the hip, the utmost good may be obtained. In private practice, when the leg can be dressed daily, the ulcer, with its dressing, and the whole limb may be covered with strapping. The strapping, therefore, ought to be good, not such thin material as that spread on calico, nor thick felt strapping, but that spread on linen, such as is sold by Leslie, or Messrs. Tanner & Co., Tottenham High Cross, London, and used at Guy's Hospital. The rubber bandage, is, however, to be preferred to the strapping.

May become painful and irritable. When the sore is painful, or the patient has an irritable pulse, the beneficial effects of opium twice a day in a pill are very marked; and quinine, iron, nux vomica, or the vegetable bitters may be given, as the wants of the case indicate. The bowels also require attention,

Transplantation in extensive ulcers. drachm doses of the sulphate of magnesia, with quinine, being a good aperient. When the sore is unusually large, and there is little probability of the whole from loss of skin healing, fresh centres of *cutification* should be inserted by transplantation. In this way I have brought about the cicatrisation of a large sore of twenty-four years' standing in three weeks, and many others of smaller size in an equally short period; indeed, by this practice of skin grafting, I believe the necessity of amputation in the more severe forms of this affection will be greatly diminished; for hitherto, indolent ulcers that surround a limb have ever proved themselves incurable, amputation being their only remedy.

The inflamed ulcer. All sores may inflame or become irritable, but there is an *inflamed sore* or *ulcer* which is found in subjects with thin and fair skins, who are in some way reduced in power, or 'out of sorts,' either from irregular living, over-work, or bad feeding. It appears as a small

Eczematous. superficial, inflamed, irritable sore, with a raw-looking appearance, an ash-coloured slough, or thick secretion over its surface, and discharges a thin, ichorous fluid, sometimes tinged with blood. The patient will complain of its excessive painfulness, particularly at night, and will dread its being touched. It will look red and angry, though superficial. A blow or a graze may have caused it, or a local patch of eczematous inflammation preceded it, in which case it may be described as an *eczematous ulcer*.

Treatment of inflamed and irritable ulcer. The *treatment* of these sores is very troublesome, the skin being usually highly sensitive. They always want soothing, and the best lotion is one of diacetate of lead mixed with the extract of opium; but this sometimes irritates, while the lead or zinc ointment gives comfort. At other times a cold bread poultice is the best application. In all cases the limb wants rest and elevation. In the eczematous sore, where the discharge from the eruption round the sore is profuse, the powdered oxide of zinc and starch, in equal proportions, may be used; or the surface may be washed with a solution of nitrate of silver in the proportion of ten grains to the ounce. Occasionally a solution of

the extract of opium is the best lotion. Simple nutritious food, with a moderate allowance of stimulants, should be administered, but all high feeding is injurious. The general health mostly requires tonics of a non-stimulating kind, such as the vegetable bitters with alkalies, as the intestines are generally irritable. When the pain is severe, opiates and sedatives are indicated. In very inflamed ulcers the application of a few leeches, at some distance from their edge, occasionally gives relief. These sores are invariably obstinate.

Varicose ulcer.

Authors describe a *varicose ulcer*, but does such an ulcer exist? Many indolent sores are doubtless associated with varicose veins, and are probably indolent on account of this association; but how far they are really caused by them is a different matter, for varicose veins and ulcers of all kinds are constantly met with together. Of all ulcers entitled to the term varicose, the eczematous has probably the most claim, for certainly eczema of the leg is a common consequence of varicose veins, and an ulcer the result of the eczema.

Ulcer associated with varicose veins.

Must treat the varicose veins at the same time.

Practically, however, it is well to remember that, when varicose veins exist *with* an ulcer, repair cannot go on favorably unless the venous circulation of the limb be assisted by position or pressure; and that where these varicose veins are present, all ulcers or sores, if neglected, are disposed to become indolent. When an ulcer takes its origin from an inflamed vein the term is applicable, in a measure, but this ulcer has no special characteristics.

Sores that are prevented from healing by varicose veins must be treated by the elevated position of the limb, or by the use of the rubber bandage or strapping; and, in bad cases, by the obliteration of the veins. Without this obliteration the treatment will, of necessity, fail; whereas with it the sore may be expected to heal with the use of such general and local means as its nature may require.

Question of healing chronic ulcers.

How far it is right to heal an old chronic sore has not yet been quite decided. Older surgeons declared it to be inexpedient, as cases were met with in which apoplexy or some other alarming condition supervened. Modern surgeons, however, are disposed to question the explanation of these facts, and to look upon that practice as beneficial which removes any abnormal condition, local or general. Still, it is wise, when a patient has been in the habit of losing by discharge from the surface of a sore, a certain amount of material which would otherwise have been used to maintain the general powers, to cut off the supplies in another way, to order more abstemious living, and to regulate the bowels by some saline water, natural or artificial, as may suit the stomach.

Sloughing ulcers.

Sloughing and phagedænic sores are rarely seen, except in connection with syphilis or hospital gangrene. In syphilis, sloughing is found in the intemperate and ill-fed, and mostly in gin-drinking prostitutes. It attacks any surface that has been made sore, either from venereal contact or other causes; and it is marked by the rapid way in which the process destroys tissues, by the fœtid character of the discharge, the great depression of power which is an invariable accompaniment, and the constitutional disturbance.

Treatment sloughing ulcers.

Opium in full doses is required for their TREATMENT, with tonics and good nutritious food. *When these means do not control* the ulceration, *the application of strong nitric acid with a piece of* wood to the sur-

face of the sore is often useful; sometimes, too, the local application of iodoform, iodine or bromine in solution is of great benefit. Fresh air is always indicated, and abundance of disinfectants, such as Condy's fluid, terebene, or carbolic acid in some of its forms. These sores are mostly due to some feeble constitutional condition, and not to a local cause, although at times the action seems local, when the application of some powerful escharotic, such as nitric acid, is called for.

Paget's description of cold ulcers.

Sir J. Paget describes *cold ulcers*:—"They are like small inflammatory ulcers, occurring spontaneously in the extremities, especially at the ends of the fingers or toes, or at the roots of the nails. In some cases they are preceded by severe pain and small gangrenous spots. They are, in many respects, like ulcerated chilblains, but they occur without any exposure to intense cold in patients whose feet and hands are commonly, or even habitually, but little warmer than the atmosphere they live in. Such patients are among those who say they are never warm, and the skin of their extremities, unless artificially heated, is to the touch like the surface of a cold-blooded animal. With this defect, which is common in women, there is a small feeble pulse, a dull or half livid tint in the parts which in healthy people are ruddy, a weak digestion, constipated bowels, and scanty menstruation.

Treatment of cold ulcers.

"The cure of the ulcers and prevention of their recurrence lie in the remedy of these defects. Many tonic medicines may be useful, but the most so is iron; with it purgatives are generally necessary, *e. g.* small doses of mercury and aloes or sulphate of magnesia. Full diet, exercise in the fresh air, dry warm clothing, especially of the lower half of the body, and warm bathing are required; dry applications, or lotion of sulphate of zinc or copper, are the best local means, and the part must be kept warm; healing is always tardy at a low temperature."

Allied to cold ulcers are those formed on fingers or other parts which have been deprived of their nerve supply by some injury.

Busk's scorbutic ulcer.

Scorbutic Ulcer.—In Sir J. Paget's able article in 'Holmes's System' occurs the following description of the scorbutic ulcer by Mr. Busk:—"Although scurvy in itself cannot be said to be attended with any peculiar form of ulceration, ulcers or sores of any kind already existing from other causes assume, in consequence of this scorbutic taint, a more or less peculiar character, and, when thus modified, have been usually termed 'scorbutic ulcers.'

Pathology of scurvy.

"Scurvy essentially consists in an alteration in the constitution of the blood, which leads to the effusion into the various tissues of a *fibrinous exudation*, usually deeply coloured, and which has on that account been commonly regarded as a simple coagulum. That this effusion, however, can scarcely be regarded in this light, is proved by several considerations, but more especially by the circumstance that it is from the first *solid* and *capable of becoming imperfectly* organised; that is to say, it is after a time permeated by newly-formed vascular channels. It is the presence of this effusion which causes the spongy swelling of the gums, the tumefaction and induration of the intermuscular tissue, the so-termed *scorbutic nodes*, and which, when poured out on the surface, or in the substance of the corium, constitutes the vibices and petechiæ so characteristic of the disease. It is the *effusion also of the same semiplastic material on the free surface of sores or ulcers which gives them the peculiar aspect termed scorbutic.*"

"Ulcers of this kind are distinguished by their livid colour and irregular tumid border, around which no trace of cicatrisation is evident, whilst the surface of the sore is covered with a spongy dark-coloured, strongly adherent, fœtid crust, whose removal is attended with free bleeding, and is followed by a rapid reproduction of the same material. This crust, in bad cases, as remarked by Lind, attains to a 'monstrous size,' and constitutes what has been appropriately termed by sailors 'bullock's liver.'" Character of the scorbutic ulcer.

The Syphilitic Superficial Sore.—The deep cellulo-membranous syphilitic sore has been already described (page 83), under the heading of constitutional sores, but the *superficial, cutaneous, rupial syphilitic* sore deserves notice, because it is very common. It mostly succeeds an ecthyma or rupia, is mixed with the eruption in some other stages, and is simply an ulceration of the base of a syphilitic eruption. This goes on increasing irregularly in a serpiginous form, the sore healing in one place and spreading in another; but it involves only the skin. The edges of the sore, or sores—for they are often numerous—are usually well defined, and frequently irregular; the surface too is generally of a deep colour; and, when healing, may either scab or granulate, as any other sore. They are met with at any period after the first constitutional symptoms of syphilis have passed away, and occasionally at a remote date; they are always found in a cachectic or enfeebled subject; indeed, it appears as if want of power allowed the disease to manifest itself in the new form. Period of appearance.

The treatment of these sores, when once they have been recognised, is not usually difficult. Tonics, with the iodide of potassium or sodium, in doses of from three to ten grains, usually effect a cure, at least for a time; liquor cinchonæ and compound spirit of ammonia in half-drachm doses are also good remedies. In other cases, the mineral acids, quinine or iron is indicated. Mercurial remedies are sometimes, though rarely, necessary; and of these the perchloride of mercury, in doses of $\frac{1}{10}$th of a grain in bark, green iodide in one-grain doses in a pill, or the mercurial suppository, are the best forms to employ. Treatment of the cellular-membranous ulcer.

Locally, the sores may be dressed with any simple dressing, but when indolent, a mercurial lotion, as the black wash, is the best.

Lupus, for convenience sake, must be classed amongst the ulcers. It is met with in two forms—the "*lupus erythematosus*" and the "*lupus vulgaris*"—the latter being more common in young scrofulous subjects, and the former in the middle-aged. When associated with a spreading ulceration, it has been called "*lupus exedens.*" On lupus. Varieties.

The "lupus erythematosus" occurs chiefly upon the face, and is symmetrical; each patch has well-defined edges, and a red, scaly surface, with small horny points upon it, due to accumulation in the dilated mouths of sebaceous ducts. The "lupus vulgaris" has its origin in a skin tubercle, or tubercles, of a flat form, fleshy consistence, and pink shining appearance, and these at times ulcerate. This lupus ulceration when once originated, progresses steadily, destroying every tissue it attacks, and when it reaches the nose—its very favourite seat—it simulates cancer. The surface of the sore is sometimes free from all signs of granulations, and often very irregular, while the edges are ragged, raised, and often everted. It is painless. The tubercles themselves feel spongy, are neither so hard nor so well defined as cancer; they are composed of granulation tissue. Characters of lupus ulceration.

These lupus ulcers are more commonly found on the face than elsewhere, and probably next in frequency, on the female genitals. They are most destructive when left alone, but often very amenable to treatment. In young adult life they are more common than in the old, and appear closely allied to tuberculosis.

Treatment of lupus ulcers.

TREATMENT.—Although the disease has probably a constitutional origin, and requires tonic treatment, both by medicine and regimen, there is no disease that derives more benefit from local treatment. When the ulceration is *superficial*, and the skin is not deeply infiltrated, the local application of cod-liver oil on lint, and the covering up of the part with cotton wool to keep it warm, at times works wonders. But under other circumstances, when the skin is *deeply* involved and infiltrated with disease, the free removal of the whole growth is the most efficient treatment, and this may be carried out by carefully scraping the surface of the growth, or by destroying it with the cautery or caustics.

Their local destruction.

Value of scraping.

The most successful method is unquestionably the scraping, so long as it is done boldly and effectually, for every particle of infiltrating tissue must be scraped away, and a blunt knife or a sharp spoon is the best instrument to use. After scraping, it is well to dress the wound with lint soaked in liquid carbolic acid. If a healthy action follows the operation, all is well, and the parts will heal under a dressing of cod-liver oil. If any signs of disease reappear, the sharp spoon should be at once re-applied.

When scraping is rejected, the free use of the electric or gas cautery may be substituted, and so long as the local disease is effectually destroyed, the choice of means is not very material. These means, however, have entirely set aside the use of escharotics. In exceptional cases excision may be beneficial.

BED-SORES.

Bed-sores.

In theory bed-sores should never occur; yet in practice they appear in certain cases, in spite of the greatest care and attention. It is well, however, for the Surgeon to act upon the theory, as by so doing he is stimulated to do everything in his power to guard against their occurrence, and no better illustration of the old adage, "Prevention is better than cure," could be found than in such a case.

Bed-sores may briefly be described as the death of a part from mechanical pressure, the parts involved in some cases literally dying from being deprived of their nourishment by prolonged and continued pressure; in others from some inflammatory action induced by it.

Bed-sores may arise in healthy subjects who are kept unmoved for ten or fourteen days; but in the old, the fat, or very thin they may occur at an earlier date, as they do in fever cases of all kinds, and in spinal or partially paralytic cases; completely paralysed parts are less prone to slough than the partially paralysed.

Dirt and moisture, under all circumstances, accelerate their appearance.

A bed-sore may appear as a simple abrasion, a sloughing of the skin, or subcutaneous tissue, and in severer cases the exposed bone may die, and in the worst, the spinal canal may be opened.

Their treatment.

TREATMENT.—Since, as a rule, they are caused by continual pressure

on a part, they may very generally be averted by some change of the patient's position. The necessary amount of movement may, as a rule, be allowed in all medical and in most surgical cases, but local pressure under all circumstances should be periodically relieved.

The skin of the part pressed upon should be hardened by washing it, at least twice in the twenty-four hours, with some camphor spirit and water, vinegar and water, or nitrous ether and water, in the proportion of one part to three. An artificial covering of the flexible collodion is occasionally of great use.

When the parts are about to slough, these applications, however, are useless, and nothing but the removal of pressure will suffice. With this object, well-filled water beds and water or air cushions should be employed. I have found a mattress divided transversely into three parts and a water cushion substituted for the middle section of great use. At other times the sections of the mattress may be simply separated for a few inches in the line of pressure. Beds.

In spare patients, where the spinous processes of the vertebræ are prominent, thin slips of felt plaster placed vertically down the back give great relief, and the same plaster applied to other painful parts is of value; cushions of amadou and well-adjusted pads of cotton wool or spongio-piline are also always of service.

When sloughing is present, a linseed and bread poultice with a solution of carbolic acid, of iodine, Condy's fluid, or charcoal sprinkled upon the surface is the best application, though a carrot or yeast poultice occasionally cleans the wound.

When the slough has separated, some stimulating lotion or ointment may be required, and this is best applied on cotton wool. The glycerine of boracic acid, or a lotion of chloral, gr. x to the ounce, are the best applications.

In all cases where patients have to rest for a lengthened period, careful attention should be paid to keep the bed smooth, and the sheets free from rucks. Corded or feather beds should not be used, The best is a horse-hair mattress placed upon a second or spring bed.

MORTIFICATION, TRAUMATIC, ARTERIAL, AND VENOUS.

The mortification of any part of the body signifies its death. When a soft part is "dying," it is is said to be in a state of "grangrene;" and when "dead," in that of "sphacelus." The dead portion is called a "slough," and the process of separation the act of "sloughing." When bone is dead, the term "necrosis" is employed; the dead portion being called the "sequestrum," and the process of its separation "exfoliation." Definition.

The dead portion of any tissue is thrown off from the living by means of ulceration; and when the slough has separated, the parts heal by granulation, as an ordinary wound. In the "sloughing phagedæna" the two processes of ulceration and sloughing are combined, the molecular death of a part, or ulceration, going on with the more general destruction of gangrene.

Cases of mortification *may be divided into* three main groups according *to their causes, viz.:* Causes.

Traumatic.

Traumatic; **anæmic**, or *arterial*; **static**, or *venous*.

Traumatic gangrene includes cases brought about by external violence or chemical action. The term "*direct*" being applied to those in which the vitality of the part is destroyed at once, and "*indirect*" where the same result is brought about by the inflammatory action which follows an injury.

Anæmic or arterial gangrene includes cases in which a part is starved from the obstruction of its artery, either from operation, accident, or disease.

Static or venous gangrene includes those in which stagnation of blood is caused by the mechanical arrest of the circulation through the veins, complicated or not with secondary inflammatory action.

In each and all of these groups inflammation plays directly or indirectly an important part.

Moist and dry gangrene.

When mortification takes place in tissues that are filled with blood, and more particularly with inflammatory fluids, "moist, hot, or humid gangrene" is produced; but when it take place in parts in which no such stasis exists, and where death of the tissues is the result of a want of arterial supply, "dry, cold, or chronic gangrene" is caused. These two forms, however, are in a measure convertible, the rapidity of the process and the amount of inflammatory infiltration influencing the result.

Tissues suffering from defective nutrition, either as the result of some want of nerve supply or energy, or of extreme debility the consequence of severe illness, or other depressing influence, are more prone than others to mortify on slight causes.

Direct traumatic gangrene.

Direct traumatic gangrene is well exemplified in the destruction of skin from the contact of a corrosive acid, such as sulphuric or nitric; in bad burns and "smashes." It is also well illustrated in cases of extravasation of urine, or fæces, and probably also by the action of some animal poisons.

Indirect traumatic gangrene,

As seen in compound fractures.

Indirect traumatic gangrene is also well seen in the integument after the application of a blister to a child or feeble patient, the blister being followed by inflammation of the blistered part, and its subsequent death. It is more frequently met with, however, in bad compound fractures, in which the limb swells a few days after the accident, and the skin assumes a mottled and livid hue; loose blisters or phlyctenæ of raised cuticle appear on the surface, containing more or less blood-stained serum, and the tissues become sooner or later cold and insensible, the temperature of the part often falling rapidly. The fluids from the wound, likewise, soon become offensive, blood-stained, and mixed with gas, and the tissues crepitate on pressure from its presence.

Line of demarcation.

The gangrene may be limited or spreading. When the action has attained its limit, a defined vascular line, "the line of demarcation," appears, where the living tissues come in contact with the dead. In this vascular line, ulceration takes place, and if left to take its course leads to the separation of the slough from the living tissues. By it soft parts, and even bone, may be divided, the granulations as they spring up during the process of repair, materially assisting the casting off of the slough. When the deeper tissues of a limb are thus affected, they rapidly decompose, and give rise to a horrible fœtor; the extent of decomposition depending much upon the fluids

in the part. Should the limb be exposed the integument will dry, become black, and gradually wither, while the soft parts beneath will undergo decomposition.

This process is rarely attended with hæmorrhage, the vessels becoming obstructed by the coagulation of their blood during the sloughing action. In exceptional cases, however, the vessels give way; the more rapid the sloughing action in the part, the greater, apparently, being the liability to bleed. Rarely attended with hæmorrhage.

Anæmic Gangrene.—The best examples of this group are found after the application of a ligature to a large artery, such as the femoral, for aneurism or injury; after the contusion or stretching of an artery (*vide* Fig. 116) or its embolic plugging. In all these instances the part dies by starvation from want of blood, and the more sudden the act by which the supply is cut off, the greater is the probability of gangrene being the result. The more gradual occlusion of an artery, except in the aged, is more rarely followed by such a result, the collateral circulation preventing it. In the form of gangrene called "senile," it is very probable that arterial obstruction, the result of atheromatous arterial disease, or of embolic plugging of the vessel from the breaking loose of some portion of the diseased arterial coats, is the immediate cause of the gangrene; but the feebleness of old age, the degeneration of the tissues that have been badly supplied with arterial blood, coupled often with some slight local injury, are doubtless powerful agents in giving effect to the process. One or more of these agents may be the true cause of the gangrene, but in the majority of cases they are probably combined. When the gangrene is purely a dry withering or mummifying process, the cause is probably the simple want of blood supply; but when inflammation coexists, the gangrene will be moist, the feebly nourished tissues, either from injury or otherwise, becoming inflamed from some accidental cause, and ultimately dying. Examples of anæmic gangrene. Senile gangrene.

In the gangrene met with from arteritis or embolism in the young or middle aged, the dry form is the usual—the parts becoming cold, bloodless, waxy, rapidly withering, turning black and then mummifying. When caused by embolism, the onset of the gangrene, or rather the early indication of the plugging of the vessel, is marked by a sudden shooting or crampy pain down the extremity, this symptom being speedily followed by those of "arterial gangrene." Gangrene from arteritis or embolism.

When the occlusion of the vessel is gradual, this pain is not present, and the symptoms of gangrene are more chronic.

Gangrene from "cold" may be the direct result of want of blood supply, or may be indirectly caused by the inflammation due to excessive reaction *from* cold: this latter form is called secondary mortification. Gangrene following the use of the "ergot of rye" is dry, and follows precisely the same course as when due to arterial obstruction. Gangrene from cold.

Static Gangrene.—The best illustrations of this variety of gangrene which results *from obstruction*—are seen in cases of strangulated femoral hernia; where splints are too tightly applied; after the prolonged employment of the tourniquet to check hæmorrhage; in a tight paraphymosis; in the sloughing of protruding piles; in the gangrene of a limb from the pressure of an aneurism or tumour upon the chief venous trunks; Gangrene from obstruction.

in the sloughing of the legs, groins, or other parts of patients suffering from some obstructive heart disease. In all these the parts may die from blood stasis mechanically produced, though inflammation, more or less marked, with its products, has generally an important influence in producing the result.

Mortification a compound process.

Mortification is thus a compound process, and is brought about by mixed causes—direct injury—want of arterial supply—and blood stasis from mechanical obstruction to the return of the venous blood—being the three chief. At the same time, in each of the three classes of cases, inflammatory action has secondarily an important influence. Feebleness of power, from old age, want of nutrition, or deficient nerve supply in a part, at the same time renders a patient or tissue more prone to the action of these causes, and the process more active.

Constitutional symptoms attending gangrene.

The constitutional symptoms associated with gangrene vary with its cause, but under all circumstances, a depressed condition of the ordinary powers is recognisable. In traumatic inflammation, during the stage of excitement, the pulse may be rapid and the beat strong; there may be high fever, and other symptoms indicative of sthenic action, but when about to terminate in gangrene, all these symptoms will be marked by a sudden fall of the temperature of the body, say from 104° or 105° to 99° F.

Rapid fall of temperature, *vide* Peck, 'St. George's Hospital Reports' for 1868.

When the mischief is extensive, and the gangrene spreads, what are known as typhoid symptoms may supervene. In the more acute cases death takes place very rapidly, but in the chronic, the constitutional symptoms are negative.

Treatment of mortification.

TREATMENT.—The most important point the Surgeon has to bear in mind in the general treatment of every form of mortification, is, that the condition indicates a depressed state of the system; consequently his efforts should be directed towards maintaining the patient's strength and cautiously building up his feeble powers by means of nutritious food, stimulants, and tonics; allaying pain at the same time by local and general soothing remedies, such as opium, morphia, or chloral, since nothing depresses more than pain.

Causes to be ascertained.

In the local treatment of gangrene its cause has closely to be considered. To treat a case of gangrene, the result of a local injury, as one due to an obstruction of an artery would be clearly wrong; and to deal with an example of this latter form in the same manner as with another due to blood stasis, the result of mechanical obstruction to the return of the venous blood of a part, would be unscientific. I shall, therefore, consider the question of treatment as applied separately to the three groups of cases already formed.

Treatment of traumatic gangrene.

Treatment of direct traumatic gangrene, when of a *limited* nature, need cause but little anxiety. It should be treated on ordinary principles of local cleanliness, poultices, and irrigation, or the local application of absorbent cotton, with some antiseptic lotion, such as iodine lotion, sulphurous acid, Condy's fluid, carbolic acid, or chloride of zinc is all that is needed. When the slough has come away the surface is to be treated as an ordinary sore.

a. When limited.

b. When extensive.

When the gangrene is more extensive and involves possibly a portion of a limb, *but yet defined*, the expediency of removing the dead part by amputation is not to be disputed. No more of it, however, should, be sacrificed than is absolutely necessary, and to ensure this object the

flaps to cover the end of the stump may be cut of any shape. Thus, in gangrene of the leg it is better to amputate below the knee with any form of flap that can be made of sufficient size to cover in the end of the stump, than at the joint, and it is far better to amputate at the joint than above it.

Treatment of indirect traumatic gangrene.

The *treatment of indirect traumatic* or inflammatory gangrene is full of difficulties, more particularly when seen in a case of compound fracture, since to remove a limb at once, as soon as the action has declared itself, would be to take away what often might be saved, or to do that which will not arrest the disease; and, on the other hand, to defer the removal, too often diminishes the prospect of recovery; the extension of the mischief, rendering the amputation a more formidable one, or precluding the possibility of its performance. *It is wise, however, in all cases, to amputate when the gangrene is extending, owing to the infiltration into the healthy tissues of the decomposing fluids from the parts.*

Question of amputation.

In a case of compound fracture, which is so bad as to suggest the necessity of primary amputation, but in which the Surgeon has been desirous, if possible, of saving the limb, the first onset of an inflammatory action that assumes a gangrenous form should be met by amputation; while in a case less severe, where the injured limb has a good prospect of being made a useful one, an attack of inflammatory gangrene need not necessarily lead to its loss.

Cases where amputation is useless.

Where the gangrene is due to the injury, it will probably be limited, and may so terminate that a good limb can subsequently be secured. Where it is due to constitutional and not local causes, amputation of the limb will not arrest it; for the gangrenous action will in all probability attack the stump, and continue till it finds a limit or destroys life.

Rule for guidance.

When the gangrene originates from a local cause, amputation is clearly the best practice; but when from a constitutional cause, it had better not be entertained till the action has ceased, and a limit to the disease been formed. In Military Surgery there may be many reasons why this practice cannot be observed, for all conservative surgery, or treatment based on expectancy, has to be sacrificed to the exigencies of the moment.

Treatment of spreading gangrene.

How, then, it may be asked, is spreading gangrene to be treated? I reply, by maintaining the part as free as possible from all fœtid discharges, and employing incisions when necessary to secure these ends; by local cleanliness and the use of antiseptic applications, and internally tonics and good food.

Under this practice, when nature is strong enough to check the progress of the disease, a limit to its extent will be formed, and the local affection will be amenable to treatment; but when no limit takes place, death will ensue, which amputation would not have arrested.

When amputation is deemed necessary, on the arrest of the action, the limb should be removed as close as possible above the diseased part. There exists no necessity to sacrifice any tissue, and much less a joint, to make an amputation neat. The only point for consideration is, that the diseased tissues should be avoided, but beyond these no healthy structures should be sacrificed.

Treatment of anæmic gangrene

The treatment of anæmic or arterial gangrene.—The Surgeon's object should be to prevent its extension, and to assist, when called upon, the separation of the parts.

To carry out the first of these the mortified parts may be wrapped in some lint dipped in simple or carbolised oil; and the whole extremity should be raised to encourage the venous circulation, and surrounded with cotton wool to maintain its warmth.

A liberal allowance of bland nutritious food should be given, aided with stimulants and tonics to assist digestion; the circulation, too, should be sustained, though anything like over-stimulating is reprehensible. Opium also may be given to allay pain, the patient being kept gently under its influence. Where small parts only are implicated, their separation may be left to nature; but where hands or feet are involved in the gangrene, the Surgeon should assist nature's processes by amputation above or about the line of demarcation, as soon as indicated.

When a limb dies from embolic plugging, occlusion of an artery, or from the effects of ergot of rye, amputation may be performed as soon as the line of demarcation has been indicated, that is, provided the general condition of the patient be such as not to forbid it. In "senile gangrene" the interference should be of the mildest kind.

Treatment of senile gangrene.

Where "sphacelus" takes place after the application of a ligature to a large artery, early amputation is sometimes called for, it being at times wise to remove the limb above the line of ligature rather than to wait for nature to indicate the point, particularly when the limb is œdematous from blood stasis and infiltrated with inflammatory products; this practice saving much constitutional disturbance and economising power. In cases, however, in which the gangrene assumes the anæmic form and spreads slowly, a line of demarcation may be waited for, more particularly when the constitutional condition of the patient is good.

Treatment of static gangrene.

In the treatment of the third group of cases, those of "static gangrene," caused by the mechanical obstruction to the return of blood from a part, the first thing to be done is to remove the cause. In hernia this is accomplished by dividing the stricture; in paraphymosis by freeing the prepuce; and when the result of the application of a tourniquet or splints, by their removal. By this course, if the parts involved are not irreparably lost, a recovery may take place by natural processes, their venous circulation being aided by position and other means. When gangrene, however, has taken place in a limb, its early amputation is necessary, it being wiser to remove the dead part at once before the setting in of secondary inflammation which may spread and cause more loss of tissue; the point of application of the mechanical force fairly indicating the extent of mischief.

In gangrene of a limb from a ruptured artery or aneurism, the same practice should be resorted to for similar reasons; delay, under all these circumstances, being unnecessary as well as injurious.

HOSPITAL GANGRENE,

Causes.

or sloughing phagedæna, is an affection that attacks wounded or injured parts, and chiefly in over-crowded, badly ventilated, or ill-drained hospitals. At times it presents itself as if generated in a ward too closely filled with patients who have suppurating wounds; at others, as if conveyed into a ward by the introduction of a sloughing or fœtid sore. Want of cleanliness in the treatment of suppurating

wounds and want of attention to sanitary laws have undoubtedly much to do with its propagation, for the disease seems to be contagious as well as infectious, through its discharges. Its contagious character is admitted by all, though some dispute its infectiousness. Guthrie, however, in his 'Commentaries,' relates the following striking fact bearing upon the point:—"Burgmans says, that hospital gangrene prevailed in one of the low wards at Leyden, in 1798, whilst the ward above it was free. The Surgeon made an opening in the ceiling between the two, in order to ventilate the lower or affected ward, and in thirty hours, three patients, who lay next the opening, were attacked by the disease, which soon spread through the whole ward."

Two forms of the disease exist. In one the gangrene takes place by small sloughs, and the ulcerative action is the more violent; wounds attacked with it rapidly spread, and skin, subcutaneous and connective tissues all disappear under its action. Blackadder relates how a vesicle forms and ulcerates, and the ulceration rapidly spreads, leaving a sharp well-defined edge to the ulcer. This form of the affection Delpech designated "ulcerous," and Boggie "phagedæna gangrenosa." Two forms: *a.* Ulceration.

In the second form the tissues die in masses, forming pale, ash-coloured, pultaceous, horribly offensive sloughs; these sloughs giving the old term "putrid degeneration" to the disease. In one epidemic the ulcerative form will predominate, in another the sloughing, and, at times, it appears as if one form of the disease would give place to the other. As a rule, though not always, an open wound seems requisite for the disease to fix upon. In 1849, when the wards of Guy's Hospital *last* contained such cases, a contused part often took on the action, and the gangrene commenced as a vesicle the base of which turned at once into a greyish slough, which rapidly extended. When it attacked a wound, the edges or surface would first cease to secrete, then assume a grey colour, and slough; and this action would spread, small wounds becoming large, even in twenty-four hours. When the slough had ceased to spread, ulceration would throw it off; and the fœtor of the slough, with the *debris* of the ulcerating tissues, formed a mass of decomposing material unequalled in any other affection. Skin readily died under the influence of the process on the connective tissue; and muscles became involved; tendons and vessels gave way only in prolonged cases, and hæmorrhage was rare. *b.* Sloughing. Where following contusion. Wound.

The constitutional symptoms of the disease in the epidemic I have witnessed, were absent at the outset, and there was certainly neither fever nor other disturbance to indicate the approach of the action; yet when the local disease had once manifested itself, great depression became very general. It was always remarked, however, that the constitutional symptoms were never in proportion to the extent of the local affection. When strong subjects were attacked the local mischief told but little upon their powers; while with feeble subjects the effects were more marked. Constitutional symptoms.

Military Surgeons, however, have related that the constitutional often preceded the local symptoms. Hennan states this very clearly; and Thompson, of America, found a like result; while Blackadder, Delpech, Guthrie, and Macleod, found the local affection took precedence in point of time.

It would rather appear from the descriptions given of the epidemic at various times, that the ulcerative form is more commonly preceded by constitutional symptoms than the sloughing—the sloughing being, apparently, a local affection at the first.

Billroth on diphtheritic infiltration.

During the late German campaign Professor Billroth met with a wound disease, which he had not seen before, and which he terms "diphtheritic phlegmon," or "diphtheritic infiltration," and he describes three cases in which the diphtheritic appearance occurred soon after operations, and was speedily followed by fatal collapse. In these the surface of the wound assumed a pale grey or white colour, and the entire muscular structure of the part became hard and stiff, from an indurated infiltration. The affection was distinguished from gangrene by an absence of any rapid increase of the ulcerative process or of inflammatory redness in the vicinity; and by the surface of the wound exhibiting a lardaceous grey or whiteness, and not the greasy pulpiness of hospital gangrene. The broad, hard infiltration so soon following the operation, might seem to be due to contagion, by means of the dressings employed, but this was scarcely probable. In its sporadic form it especially appears to affect the subjects of septic or pyæmic disease, and perhaps, certain conditions of the secretions inclined to coagulation may favour its production.

Treatment of hospital gangrene.

TREATMENT.—*Abundance of fresh air*, as maintained by a constant current allowed to pass through the ward or room is most essential; with isolation, the free use of antiseptics, and close attention to all sanitary measures. During the early stages of the disease irrigation seems to be the best local treatment, with the removal of *all sloughs and putrescent material*, by carefully cutting the existing slough with scissors or scalpel aided by the dressing forceps, and mopping the surface of the wound with cotton wool or tow, thus *thoroughly cleansing the whole surface of the wound*. The next aim is to prevent the extension or return of the sloughing, by means of local applications, and of these nitric acid was formerly the chief, the acid being freely applied to the diseased parts, and carefully introduced into every hollow and excavation into which it could percolate.

Local measures.

To apply the acid, writes Welbank, "the sore must be thoroughly cleansed, and all its moisture absorbed by lint or tow. The surrounding parts must next be defended with a thick layer of ointment; then a thick pledget of lint, which may be conveniently fastened to the end of a stick, is to be imbued with the acid, and to be pressed steadily on every part of the diseased surface till the latter is converted into a dry, firm, and insensible mass. The part may then be covered with simple dressings and cloths wet with cold water."

Dr. Goldsmith, of America, and others, have spoken very highly of the value of bromine as an application, which arrests ulceration, and turns sloughs into tough deodorised tissues. It should be applied freely, to the whole surface, and its application should be repeated when the sloughing or ulceration spreads. Iodine, carbolic acid, and the oil of turpentine have also been advocated, and the latter, it is said, has the power to dissolve the sloughs and change the action of the disease. Delpech and some Surgeons speak

highly of the actual cautery, and when the benzoline cautery is to be had, it might be used. The object of all these different plans of treatment is to excite a new action on the surface of the wound, and to destroy the sloughing tissues which, doubtless, by mere contact, have a power of keeping up or propagating the disease.

When the sore is extensive, an anæsthetic should be administered during this local treatment. After the cauterisation, the surface of the sore should be dressed with carbolic or terebene oil, whilst laudanum, iodine lotion, or bromine in solution, two drops to the ounce of water, is also beneficial.

Dr. Packard, of Philadelphia, used powdered sugar or thick syrup; sugar being a hydrate of carbon which does not give up its oxygen. He dusted the parts with the sugar, and covered the whole with wet lint. When odour exists, charcoal should be mixed with the sugar.

Constitutional treatment

The constitutional treatment consists in abundance of light, nutritious food, milk being administered as freely as it can be taken, with sufficient stimulants to maintain the circulatory system, and assist digestion.

Tonics, such as quinine and iron, are often well born in large doses, five grains of the former dissolved in half a drachm of the tincture of the perchloride of iron being a good recipe, or, when quinine cannot be taken, the tincture of nux vomica in ten-drop doses may be substituted. Opium is an admirable drug when the ulcerative action is present, but in the sloughing stage it is not so satisfactory. Chloral is probably a good remedy for a like purpose.

ERYSIPELAS.

Definition.

Erysipelas is a contagious and infectious specific disease due to the presence of some blood poison that has probably been introduced into the body from without. It is intimately allied with other blood poisons, such as are found in scarlet or puerperal fevers, or septicæmia in any of its forms; for these poisons seem to be convertible. It is connected with defects of drainage or ventilation, but is not so much an hospital disease as is generally believed, only 186 cases having taken place in Guy's Hospital in the eight years ending with 1879 out of 18922 surgical patients which were admitted, or less than one per cent. No less than 451 cases were however admitted *with* the affection, and some of those recorded as having been transferred from one of the wards, simply passed through it.

Not hospital disease.

Varieties.

It manifests its presence in three forms:—As a diffused cutaneous inflammation, "simple cutaneous erysipelas;" as a diffused inflammation of the cellular tissue, "diffused cellular inflammation;" and as a diffused inflammation of both skin and cellular tissue combined, "phlegmonous erysipelas;" the two latter being included in the expression "cellulo-cutaneous." The state of the system, the temperament and habits of the individual, have much to do in determining the form of the affection. When the disease follows an injury, it is called "traumatic;" when it occurs spontaneously, it is styled "idiopathic."

Its essential characters.

The peculiarity of erysipelas lies in the diffused character of the

inflammation and in its atonic nature. It is both *infectious* and *contagious*.

a. Constitutional symptoms.

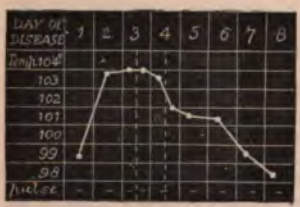
The attack is occasionally preceded by some constitutional disturbance, but as often as not, such has not been observed; the severity of the general symptoms, moreover, in no way bears any proportion to that of the local disease. Febrile symptoms ushered in by chilliness and *rigor*, are the most common, the tongue being probably foul, and the bowels either constipated or relaxed. As the disease advances, the fever runs high, and delirium of different forms appear; the pulse becomes quickened; if full, it will always be compressible, and often irregular or intermittent. Towards the close of the disease, particularly when terminating unfavorably, the pulse will be small and weak. The temperature at the first onset of this disease as a rule rises rapidly, and in its decline, falls as fast (*vide* figs. 12 and 13). When the temperature remains high, a bad prognosis should be given.

C. de Morgan, Nunneley, and H. Bird assert that, if the pulse rise in frequency after the sixth or seventh day, it is a very bad sign. I cannot, however, endorse this observation, although, as the end of the first week is about the time that complications appear if they occur at all, it may possibly be correct.

Premonitory affection of cervical glands.

Frank has pointed out that when a patient has had febrile symptoms for some hours attended with pain, tenderness, and swelling of the

FIG. 12.



Thermograph of erysipelas supervening upon removal of the tarsal bones after the traumatic temperature had subsided, showing rapid elevation of temperature—nearly 5 degrees—at the onset of the disease and steady fall during convalescence. Case of H. B., æt. 32.

FIG 13.



Thermograph of erysipelas in man, æt. 29, after removal of parotid tumour. Operation (day 1) followed by slight traumatic fever (day 2) and steady fall in temperature. Elevation of temperature (day 4) when blush first became visible, and steady rise for three days during increase of disease with rapid fall on its subsidence. Convalescence on 11th day.

lymphatic glands of the part, there is no doubt that erysipelas is coming on. Chomel held the same view, and Campbell de Morgan relates "that Busk is so convinced of the invariable occurrence of affection of the glands before erysipelas appears, as to consider it a pathognomonic symptom," and he believes that, although the blood became affected, the actual primary seat of the local inflammation was in the absorbent system. Sometimes swelling and excessive tender-

ness of the glands precede by many hours the appearance of a blush on the skin. These views accord well with those which Dr. Bastian brought before the Pathological Society in 1869, based on the post-mortem examination of a man who died from erysipelas in a state of delirium and stupor. In this case finding the small arteries and capillaries of the brain plugged with embolic masses of white blood-corpuscles, he suggested this condition as the cause of the delirium. He stated "that the blood change is a general one, and through every part of the body this blood is carried with its rebellious white corpuscles, so that we may expect that in all organs alike the same obliterations of small arteries and capillaries take place." Thus, when those of the liver are involved, jaundice may be produced, and when those of the kidney, albuminuria, these conditions being occasionally found in erysipelas.

Dr. Bastian's views.

Capillary embolism.

If we accept Dr. Bastian's observations pathologically, and look to the condition of the white blood-corpuscles for an explanation of many of the phenomena of erysipelas, we may fairly admit the inference from clinical observations respecting the absorbent system to which Frank and Busk have called our attention, for the glands of this system and the white blood-corpuscles are generally recognised as having a close relationship. These views receive much confirmation from the pathological observations to be read on page 103.

Local symptoms.

b. Local symptoms.

In the *simple* form of cutaneous erysipelas, mere excess of vascularity as indicated by the vivid redness of the part affected, is the chief local symptom, and with this there is a sensation of heat or tingling in the part, and, in rare instances, the formation of small vesications. The border of inflammation is invariably well defined. The redness, which spreads rapidly, disappears on pressure, to return directly the pressure is removed, but there will be no pitting of the parts to indicate œdema. In a day or two these symptoms will subside or disappear, and the cuticle will desquamate.

In mild form.

In the *more severe* form of cutaneous erysipelas, the vascularity of the skin will be as intense as in the simple, but it may be more livid. It will, however, be associated with some perceptible thickening of the parts — the inflamed tissues feeling raised on palpation. Where much cellular tissue exists, as in the eyelids or scrotum, œdema will rapidly show itself. Small or large vesicles may likewise form on the surface containing either a clear serum, or a blood-stained or sero-purulent fluid, the latter form indicating great depression. In the head or other parts where the skin is tight, the feeling of tension is very great, and the surface looks shining, the features being altogether obliterated. There is rarely, however, much pain.

In severer form.

The disease runs its course in about ten days. During the first three or four it spreads, and having reached its height, declines, the redness and swelling gradually subsiding and the skin desquamating. In some cases a local suppuration takes place, and this is always to be suspected when any local redness remains after the subsidence of the inflammation. In the eyelids and other parts containing loose cellular tissue such a result is common. In the cachectic subject the disease is always more œdematous than in the healthy. When it attacks a wound the general symptoms are the same, but the local consist in arrest of secretion in the part, then ulceration, and later on, where union has existed,

Course and duration.

disunion; stumps and wounds sometimes reopening and discharging a thin ichorous fluid.

After the disease has subsided, repair is usually slow, but at times it goes on healthily to complete recovery.

Prognosis. Simple erysipelas, unless in the feeble or cachectic, is rarely a disease of much danger. In free living subjects, and in others who have bad viscera, it is, however, a dangerous affection, lighting up latent disease that often proves fatal. When it attacks the scalp after head injuries it is exceptional to find it followed by bad consequences.

Where the erysipelas attacks the mucous lining of the throat, fauces, or larynx, it may, from mechanical causes threaten life.

In some cases the disease will affect different parts of the body consecutively, or leave one spot to attack suddenly another. Such cases usually indicate want of power, and too often are found in those who have some organic disease of the kidney or other excretory organ.

On diffused cellular inflammation as a form of erysipelas. **Diffuse cellular inflammation** may clinically be looked upon as a form of erysipelas, the disease attacking primarily the cellular tissue instead of the skin. It is characterised by the same diffused form of inflammation and by the same atonic character. It is, however, more frequently the result of some local injury such as a punctured or dissection wound than is the simple form, and it is even found in patients from whom no such history can be obtained. It is generally associated with absorbent inflammation and glandular enlargement.

Local symptoms. The disease appears as a diffused swelling and induration of the cellular tissue of the part affected, the tissues feeling infiltrated and brawny, and the skin tense from over-distension. When suppuration or sloughing of the cellular tissue has taken place, fluctuation or crepitation will be detected or the parts may feel boggy. The skin, if not previously inflamed, will now participate in the disease; it will inflame, ulcerate, or slough, to permit the escape of the pent-up pus or sloughing cellular tissue. When resolution takes place at an early period of this affection, the skin may escape uninjured, but such a result is rare.

Constitutional. The constitutional symptoms attending these changes in the cellular tissue are always those of great depression. The febrile symptoms will be of the typhoid type, the pulse feeble although rapid from the first, and the disposition to sink very marked. Profuse sweating is an early and constant symptom. Delirium also is sometimes present. Visceral complications are, as a rule, the cause of death, the connection between this affection and pyæmia being very close.

On phlegmonous erysipelas. **Phlegmonous erysipelas** is a combination of the two former. It is far more serious than the simple, and as much so as the cellular inflammation. It is characterised by a diffused inflammation of the skin and cellular tissue together, the parts having a strong disposition to suppurate and slough. It is commonly the result of some punctured wound or injury involving the skin and cellular tissue beneath, and begins locally as a brawny infiltration of the part, the skin presenting erysipelatous redness, of a dusky hue, and the boundary between the inflamed and uninflamed skin being ill marked; outside the limit of the redness the skin feels unnaturally firm, and the cellular tissue beneath as if infiltrated. To the finger the inflamed parts feel more solid,

Local symptoms.

and pit on pressure. Resolution is almost unknown as a termination of the disease, one case differing from another only in the extent of the destruction of tissue with which it is accompanied.

Progress of phlegmonous erysipelas.

As the disease progresses, and the cellular tissue beneath the integument becomes infiltrated with inflammatory products, the skin will be made tense, and cease to pit; uniform hardness of the tissues will give place to a sense of fluctuation, as of fluid, or to a boggy, quaggy, crepitating feel of sloughing cellular tissue.

Sloughing of tissues.

If the case be left to nature, the skin will become thin and ulcerate in parts or slough in masses, to give vent to the pent-up and sloughing tissues. Phlyctænæ will also appear over the dead portions of skin as in other forms of gangrene, while the pus and sloughs which escape are always fœtid. In bad cases the whole cellular tissue of a limb, with large portions of integument, in this way may die; bands of skin, held down by fascia, being left, which, during recovery, will become the centres of cutification.

In the ordinary run of cases, this diffused infiltration of the cellular tissue is confined by the fascia to the subcutaneous tissue; but in some instances, the cellular tissue that separates the muscles becomes involved, when the case assumes a far more serious aspect, for the suppuration is then of a burrowing kind, and the sloughing is more extensive. The prospect of recovery, with a useful muscle, becomes also very slender, for muscles and tendons may not only slough wholly or in part, but on recovery taking place they may become so closely bound together with the other tissues that they are useless as moving organs. From this cause, after phlegmonous inflammation of the hand and forearm, a stiff and immovable extremity is often met with, and the hand becomes a kind of fin.

Severity of constitutional symptoms.

The constitutional symptoms associated with phlegmonous erysipelas vary considerably, and their severity depends much upon the rapidity with which the disease spreads. They are, however, in character the same as are found in other forms of the affection, though they are probably more severe. The rigors are more marked, the fever higher, the pulse more rapid, and the tendency to fall in power always greater. Thus, in the suppurative or sloughing stage of the disease the rigors frequently recur, and cold sweats and fever intervene as in an ague. When the local affection is undergoing repair, or, at any rate, has ceased to spread, and these "false ague fits" persist, some internal or visceral complication may be looked for, the blood becomes poisoned as in septicæmia, often to the extent of destroying life.

Pathological appearances found in erysipelas.

The pathological appearances met with in cases of death from erysipelas have been kindly drawn up for me by Dr. J. F. Goodhart, after a careful analysis of the post-mortem records of the hospital. They admit of being classified as *local* and *general*, the former including all those morbid changes which occur in the primary focus and in the surrounding parts directly extending from it; the latter, the various alterations of blood or tissue found in any secondary foci or in the system at large.

Local.

The *local* changes vary according to the severity of the disease and the rapidity with which it causes death.

In the slighter forms, where it has not been the immediate cause, but has supervened as an intercurrent affection in the course of some other

disease, it may often happen that no morbid appearance is visible post-mortem indicating erysipelas. Again, the skin alone may be affected either with a mere faint purple discoloration or with slight œdema, or the cuticle may be raised into bullæ or separated more or less around. In more pronounced cases, the areolar tissue beneath the skin and along the tendons and intermuscular septa has numerous minute ecchymoses and extravasations of blood in it, and is often soaked with yellow serum or gelatinous matter, apparently produced by a delicate fibrinous coagulum; in the more prolonged or in severe cases the serum is replaced by healthy pus. Ecchymoses in the subcutaneous areolar tissue are very common, even in cases where death has been very rapid and no other morbid appearances are seen.

It is characteristic of the further changes that there is no tendency to the limitation of the disease around the primary focus; the pus or serum leads to the formation of no abscess sac, but spreads along the subcutaneous tissues and intermuscular septa, sometimes even making a complete dissection of some of the muscles.

There may or may not be phlebitis in the parts. Where it exists, the interior of the veins affected is discoloured and filled with a grumous chocolate-coloured fluid, while the inner surface of the vein-wall is rough from the inflammatory processes it has undergone and the adhesion of small particles of clot. Where the disease has existed some time, a tube of semi-organised clot may line the vein, and within that will be found the broken-down clot which it is often impossible, microscopically, to distinguish from pus.

Local.

It is quite as if not more common, however, to find the vessels unaffected as to find them plugged. Pus may even run along their course, sometimes apparently in their adventitia, or more often immediately outside it, and still lead to no clotting. On microscopical examination in these cases the pus is seen to lie in smooth-walled channels which in all probability are lymphatic spaces (suppurative lymphangitis).

Affection of glands.

The neighbouring lymphatic glands, *i. e.* those in the groin if the disease be situated in the leg—the axillary, if in the arm—are usually swollen, red, and ecchymosed on section, and are frequently surrounded by the same kind of serous fluid as is found in the immediate neighbourhood of the primarily diseased tissue. The tissues of all the diseased parts are said to be crowded with small vegetable organisms called bacteria. These constitute the local changes. It may be as well to add, perhaps, when erysipelas affects the scalp, that a yellow colour of the vault of the skull is often observed, and also that suppuration between the bone and dura mater and suppurative arachnitis and meningitis are not very unusual sequences. About the neck it may be followed by œdema glottidis, and occasionally by pericarditis or suppurative inflammation of the mediastinum.

General.

The morbid appearances in the system at large are similar to those found in septicæmia from other causes, viz. ecchymoses about the pleura and pericardium; a fluid and sometimes treacly state of the blood, congested kidneys, and a softened state of the liver and spleen. So soft, indeed, is the latter organ that were it not for its capsule it would at times lose all shape. The blood has been said to contain bacteria, but I have never found such during life, though they are sometimes present when the blood is examined some hours after death. In

Bacteria.

addition to these *general* changes, separate foci of diffuse cellulitis are found—in both forearms and in the calf of the leg, for instance, after a primary erysipelatous state of the scrotum; and in at least two recorded cases a similar diffuse cellulitis or myocarditis has been noticed in the muscular wall of the heart. Patients with erysipelas are also liable to suppurative peritonitis and pleurisy, which, though commonly so, are not necessarily determined by the presence of a neighbouring wound. A subject of hernia or ovariotomy at a time when erysipelas is rife will be likely enough to die of suppurative peritonitis; while another who has undergone an excision of the breast may die of a similar form of pleurisy without showing any external evidence of erysipelas.

A wound, however, is not necessary. For example, in a post-mortem made not long since, a lady about sixty had been nursing a friend who died of some febrile affection called "low fever." Within a few days she herself became exceedingly ill and died quickly. The inspection revealed what had only been evidenced by the faintest blush on the skin during life—viz. an early suppurative inflammation of the cellular tissue of the right axilla and pectoral region, and pus on the surface of both pleuræ; all this without any external wound whatever.

As occasional causes of death in erysipelas may also be mentioned, acute lobar pneumonia, and a diphtheritic sloughing of the mucous coat of parts of the bowel; while to complete the history, it must also be said that at times when erysipelas is present in an hospital or its neighbourhood, not only are cases of pyæmia with its known manifestations, such as abscesses in the viscera and pus in the joints frequent; but patients suffering from chronic suppuration become feverish and die without, it may be, any adequate cause appearing in the viscera.

In this description of the pathological appearances found in erysipelas no attempt is made to distinguish between it and cellulitis. The morbid changes in both are the same, and it is as impossible in the deadhouse as at the bedside to separate the two.

Treatment of erysipelas.

TREATMENT.—The disease in all its forms is essentially an *atonic* one; consequently nothing like "antiphlogistic" remedies are to be entertained, and in the simpler forms which have a tendency to run a definite course, the practitioner has merely to guide his patient through the attack, and to ward off whatever might prove injurious. With these objects when the patient's powers are good, and no indications of feebleness manifest themselves, a mild aperient or purge, to clear out the bowels, with bland nutritious food, such as milk and beef tea, are probably sufficient remedial means; the disease, on the third or fourth day, attaining its height, and then declining.

Support the powers.

Tonics.

Should any feebleness or want of power appear at the beginning or during the course of the disease, tonics are indicated, and of these iron seems the best. The tincture of the perchloride in half drachm doses, or more to an adult, frequently repeated, with or without quinine or strychnia, acts at times like a charm, and doubtless often cuts short the disease. Its use was introduced to British surgeons by Dr. H. Bell, of Edinburgh, in 1851, although Velpeau, in 1841, had previously declared its value.

In the earliest stage of the affection, when the first patch of inflammation appears on the skin or around a wound, an emetic may at times abruptly check the attack.

Stimulants.

When food cannot be taken, stimulants must be substituted, and it

it is well to introduce into them, and particularly into stout, some essence of meat. The form of stimulant must depend upon circumstances, but, as a rule, that which the patient has been in the habit of taking is the best. When brandy is given it should be mixed with milk or eggs, it being always better not to give stimulants alone. The amount must be regulated with care, for over-excitation of the system is always bad.

Sedatives with caution.

Hypnotics or sedatives should be used with caution, for they are not usually beneficial. Of these, chloral seems less liable to disagree than opium; camphor and henbane in five-grain doses, are thought well of by some, while ammonia is as highly recommended by others.

In phlegmonous and cellular erysipelas the same principles of practice are applicable. In the suppurative or sloughing stages it is necessary to give abundance of good food of all kinds, and stimulants in proportion; strong animal broths and milk are the best forms of diet.

Local treatment of erysipelas.

Local Treatment.—The inflamed parts should always be kept warm and raised, air being excluded from the surface; consequently, when the head and face are implicated with simple erysipelas, the old practice of dusting the parts with flour, fuller's earth, starch or oxide of zinc is effective. Mr. C. De Morgan used cotton wool in addition.

In simple form.

Warm applications, however, are in some cases the best, especially the lead lotion with opium. Cold is always injurious.

In the face and head, when the parts are tense and painful, relief is readily given by following the practice of Sir R. Dobson in puncturing the skin with a series of small punctures—oozing of blood or serum being encouraged by warm applications.

In erysipelas of other parts the application of the tincture of iodine is to be recommended. Mr. Luke thought highly of the free use of collodion, applied over the part. Mr. Higginbottom, of a solution of nitrate of silver, twenty grains to the drachm of water; others, of the tincture of the perchloride of iron. I have employed at times all these, and prefer the tincture of iodine to any, but none of them have any certain power of arresting the progress of the disease. Some American Surgeons speak strongly in favour of the application of a solution of bromine on lint, with oil-silk over the whole; and quite recently the subcutaneous injection of a solution of carbolic acid has been highly spoken of. Mr. Barwell has advocated white paint.

Local treatment of cellulo-cutaneous form.

The local treatment of the cellulo-cutaneous forms of the disease must be conducted on the same principles as the simple, but as soon as anything like tension of the integument appears, incisions should be made deep enough to allow of the escape of the effused serum from the cellular tissue beneath the skin, and long enough to relieve the tension of the whole.

Incisions.

Some, and amongst them the late Sir W. Lawrence, recommended the incision to be free, so as to extend the whole length of the affected part. Others, among whom I claim a place, prefer a greater number of limited incisions. These limited incisions answer the same purpose as the long, and are not attended with so copious a hæmorrhage, or with so great a risk to life. Even after these the bleeding is at times profuse, but it may generally be readily arrested by elevating the limb and by temporary pressure.

Relieve suppuration.

When suppuration and sloughing exist, the Surgeon must let out matter as soon as formed, for there is little doubt that the disease is

kept up by its presence. The opening into these abscesses should be free, and their cavities kept clean by careful washing out at each dressing with Condy's fluid or iodine lotion, a detail which adds materially to the comfort of the patient and the well-doing of the case. De Morgan prefers a solution of chloride of zinc, fifteen grains to the ounce. Dressings with boracic acid lotion ten grains to the ounce, and gutta percha over the wet lint, should be applied to the parts, and frequently changed. Poultices are not so good, although at times patients say they derive the most comfort from them. During the period of repair the Surgeon will often have to lay open sinuses. When the sloughing has been very severe amputation may be called for.

Avoid communicating the infection.

It has ever to be borne in mind that erysipelas is highly contagious and infectious. In hospital practice, consequently, every case, as it arises, should be separated from others in which wounds exist, and transferred to a separate ward. All dressings as they leave the ward or chamber should be burnt or disinfected; and a sponge should never be used. Plenty of fresh air ought to be admitted into the room, but no draught; and disinfectants should be freely distributed about. No medical practitioner under any circumstances should go direct from a case of erysipelas to a midwifery case, or to dress a wound of any sort, accidental or surgical. If he is obliged to attend a labour when in charge of a case of erysipelas, he should allow as much time as possible to intervene before doing so, and then should attend only after having changed his clothes, and carefully disinfected his hands, for there is a direct connection between erysipelas and puerperal fever.

Isolation and fresh air.

ERYTHEMA.

Erythema finds its place here, as in its clinical features it bears some resemblance to, and has been mistaken for, the simple cutaneous erysipelas. It appears as a roseate or more vivid injection of the skin, of a local or general character, disappearing on pressure, and accompanied with some slight degree of œdematous swelling.

Erythema.

In its *transitory* form it may be regarded as a symptom of some bowel or intestinal irritation, induced by irregularity in diet, or other cause. In so-called bilious subjects it is by no means uncommon, and a local patch of redness on some part of the face, or other part of the body, often indicates the approach of a "bilious attack." It is found, also, where organic disease of the intestines is present. In other cases it precedes an attack of smallpox, attends vaccinia, and is common in children.

When transitory.

Hebra gives the term "*erythema fugax*" to all these symptomatic forms of erythema.

Erythema, as a *disease*, more commonly attacks the extremities than the trunk, and the dorsal surfaces in preference to other parts. When the efflorescence appears in small patches of papules or tubercules upon the fingers or hands, the terms *E. papulatum* and *E. tuberculatum* are respectively given.

Erythema as a disease.

When these patches assume the form of a red ring, the term *E. annulare* is applied to it. When a second ring forms round the first, before it has passed away, or when it is represented by a small spot, the *E. iris* is formed; and where many such circles or half-circles appear together, and touch or coalesce and spread, the *E. circinatum*

Varieties.

Wilson and Hebra on erythema.

and *E. gyratum* are respectively present. Wilson mentions a case in which the *E. gyratum* covered the whole body; but all these different forms of erythema must be regarded as different stages of the same disease. Hebra says, "it will depend on the period at which the patient comes under medical observation whether the case shall be diagnosed as *E. papulatum* or *E. gyratum*." He gives one term to the whole, *E. multiforme*. As the disease subsides, a slight desquamation follows, and then some small deposit of pigment. Mr. Morrant Baker describes an *Erythema serpens* which follows a slight, probably poisoned abrasion, and spreads in a circular manner, leaving the injured part well. It generally occurs in the hand.

'St. Barthol. Hosp. Rep.,' vol. ix.

Treatment.

All these forms run a definite course, and have a tendency to get well, lasting from one to three or four weeks. They require for treatment little else than a well-selected diet and attention to the bowels.

Erythema occurs at times during the secondary stage of cholera.

The erythema that precedes or accompanies the progress of elephantiasis is worthy of notice.

Erythema nodosum.

Erythema nodosum, is a more definite affection; it is found in both sexes, but more commonly in the female; it is also usually seen upon the legs, but not rarely upon the arms as well as other parts of the body.

Characters.

It shows itself in raised and tender oval patches of a red colour, and of very variable size, some being as large as a sixpence, others as of an orange; these patches at times join. At first they are of a bright red colour, but as they die away they become of a livid hue, and appear very like bruises, like them also they lastly assume a yellow tint. The cuticle always desquamates. When the disease is limited there may be no constitutional disturbance, although occasionally some febrile symptoms appear, and there is usually some evidence of derangement of the digestive organs with a foul tongue. As often as not, however, the local disease is the first symptom that attracts attention. The eruption is often symmetrical. When it appears over the tibia and the skin is very red and painful, it is often mistaken for some more serious affection, such as periostitis; but the absence of the severe constitutional disturbance which commonly attends this affection ought to prevent such an error. The history of the case is enough to distinguish it from a bruise; and the different centres of redness or congestion from erysipelas.

Treatment of erythema nodosum.

Its *treatment* is simple. Saline purgatives, tonics, and a carefully regulated diet are, as a rule, sufficient in a general way; and the application of a lead lotion to the inflamed part, with elevation of the limbs, is generally all the local treatment that is required; but in exceptional cases warm fomentations, with or without poppy decoction, give greater comfort.

ON TRAUMATIC FEVER, SEPTICÆMIA, AND PYÆMIA.

Definition.

Inflammatory fever, surgical, suppurative, or traumatic fever; septicæmia, ichoræmia, puerperal fever, and pyæmia, may all be considered as so many different names for, and manifestations of, one condition, viz. *blood-poisoning*.

Infection from within.

In inflammatory and surgical fever "the returning fluids of the

inflamed part, its venous blood, and its lymph, are the agents of general infection" (Simon), the poisoning being "due to the introduction into the torrent of the circulation of toxic substances produced by the organism itself" (Maisonneuve), the poison being probably derived from *disintegrated tissues and generated from within the body*.

From without.

In septicæmia, ichoræmia, puerperal fever, and pyæmia, the absorption of *putrid* inflammatory products, or of pus or pus-forming material, or of some other poison, whether from a wounded part or not, is the undoubted cause of the disease; *the poison being taken into the body* either by the veins or by the absorbents *from without*. Traumatic or surgical fever may, however, pass into septicæmia, and this into pyæmia, the first being the mildest form of blood-poisoning, the last the most severe. Surgical fever generally ends in recovery; pyæmia, after the formation of secondary abscesses either in the viscera, joints, or connective tissue, in death.

Symptoms of blood-poisoning.

One and all are ushered in by very similar general symptoms, and an outline of those met with in a typical example of inflammatory fever will be found in page 70; "but practically the affection shows numberless grades and differences and complications. First, there are wide differences of degree and character, for in proportion as the local process is less acute and less extensive there is less attendant febrility; and in proportion as the local process has to invade fewer successive strata of texture, the fever is of shorter course. On the one hand, it may be so slight as readily to escape notice, and may end within a few hours of its commencement; on the other hand, it may last in full force during many successive days, and may be so severe as to shake the patient's life to its foundation; and, besides these differences, there are varieties of result, sometimes from complicative local conditions, sometimes from peculiar susceptibilities of the patient. If the wound become the seat of some large textural disorganisation, with consequent soakage of putrefying material, more marked signs of *blood pollution* may be expected to mix with or supersede those of common inflammatory fever; the patient's general state will then incline to be one of depression and apathy; his tongue will be more than commonly foul, and fœtid diarrhœa will probably exist; or if, perchance, during the local process it happen (as is especially apt to be the case where cancellous bone-structure is affected) that pus passes up a vein into the general stream of blood, the patient's improvement is abruptly cut short by the *severe recurrent rigors and sweating of pyæmia*, accompanied by local signs of secondary suppuration in parts to which the pus is conveyed." (Simon.)

Its characteristics.

Confirmed blood-poisoning, therefore, is characterised not only by all the symptoms of inflammatory fever, but by *severe rigors* breaking in upon the febrile symptoms; by *sudden and marked variations of temperature* (*vide* Fig. 14), *by profuse sweats and great depression of the patient's powers;* and when these symptoms occur in the course of an attack of inflammatory fever, severe blood-poisoning is certainly indicated; the gravity of the attack being measured by the intensity of the symptoms. We generally meet, moreover, in pyæmia with local signs of inflammation of some internal organ or external part of the body, and this inflammation runs on to the formation of *metastatic or secondary abscesses* as they are called. When an internal organ is

Internal and external pyæmia.

involved in this disease the result as a rule is fatal. When suppuration attacks the integuments or extremities, although it may be severe, there is always some hope of recovery. It is an interesting clinical fact that these two different forms are rarely met with in the same subject. They may for clearness be separately called *internal* and *external* pyæmia, or *acute* or *chronic*; pyæmia, when involving internal parts, being generally rapid in its course and fatal; and when attacking external parts, it is as a rule chronic; at times, however, the latter may supervene upon the former variety.

In many cases of pyæmia a peculiar sweet hay-like odour of the breath is undoubtedly present. Some authors, and Braidwood is amongst them, look upon this symptom as pathognomonic.

Traumatic fever.

Traumatic fever, when it occurs, generally makes its appearance from the second to the ninth day after an accident or operation, and seldom lasts over a week. In a simple case it may subside after twenty-four hours, and in a severe one it may continue for a week. When a *relapse*, or a second sudden rise of temperature takes place, grave mischief may be anticipated, as some local internal or external inflammation. Billroth has described this second attack of fever as "secondary fever." When it runs on for a more lengthened period than a week severe complications are sure to exist to keep up the symptoms. During its course the temperature of the body, naturally 98·6° F., may rise suddenly 5° or 6° F., and in ordinary cases its fall is as a rule gradual; while with its fall, defervescence takes place. Should the fall be sudden a general breakdown of the powers of the patient is indicated, and under these circumstances sloughing of the wound may be expected. The rise of temperature is generally accompanied by an arrest of secretion or some change of action in the wound, but the fall of temperature indicates the on-coming of suppuration.

Rise of temperature.

Sudden fall of temperature.

These points are well seen in the following thermographs, figs. 14, 15, 16, 17, and 18.

FIG. 14.



Thermograph of acute ostitis of the tibia in a boy, æt. 16, following a blow; admitted into Guy's on the fourteenth day with pyæmia which destroyed life nine days later. The table well shows the fluctuation of temperature which is found in pyæmia with the night and morning variations.

Traumatic fever not constant.

It is, however, important to know that traumatic fever is by no means a necessary consequence of an injury or operation, however severe; that it may follow a trivial or fail to follow a severe injury; and that it is quite impossible to predict its occurrence under any circumstances. After a large number of capital operations it is entirely absent—I should say after one third—and since the practice of the torsion of arteries has been adopted and wounds have consequently been

freed from the presence of such foreign bodies as ligatures, the number of cases in which it is absent has decidedly increased.

Fig. 15.



Thermograph of traumatic fever, rise for three days, sudden fall, after amputation at hip-joint, in a boy, æt. 9, terminating in recovery.

Fig. 16.

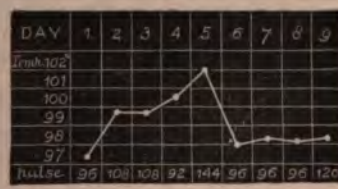


Thermograph of traumatic fever, sudden rise and steady fall after amputation of the leg for disease of foot in man, æt. 52, terminating in recovery.

When blood poisoning attacks a patient the subject of a wound, whether caused by operation or injury, it is generally to be observed that the secretion of the wound becomes sanious, serous, or fœtid; probably it will be arrested, and the surface will become glazed or glassy or perchance assume a sloughing action. The integument around the wound will often have an erythematous blush, or acquire a peculiar leaden, dusky appearance, which is somewhat typical. Union if progressing will cease or disunion may result. When any internal organ is implicated, special symptoms indicative of disturbance of its functions will be present. When the *brain* is involved there will be sleeplessness or delirium of a low muttering kind or "*relapsing unconsciousness*," unconsciousness from which the patient can be roused only to relapse. In rare cases acute delirium and mania occurs.

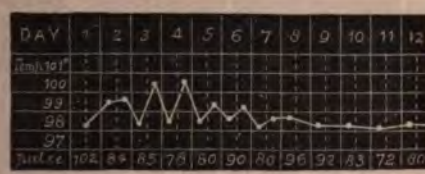
Arrest of secretion

Fig. 17



Thermograph of traumatic fever after operation for ruptured perinæum. Fever at its height on fifth day, when quill sutures were removed, after which there was a sudden fall and a steady convalescence. Patient æt. 45.

Fig. 18.



Thermograph of traumatic fever after ovariotomy in a woman, æt. 43, ending in recovery. Temperature never rose above 100.

Brain complications.

When the *respiratory organs* are involved—and it may be stated that they are so far more frequently than any other—difficulty of breathing, with a harsh dry cough, and perhaps viscid blood-stained sputum, are the prominent

Respiratory complications.

symptoms; occasionally pleuritic pains are present, or symptoms of bronchitis, with great dyspnœa.

Abdominal complications.

When the *abdominal viscera* are affected nausea or sickness and profuse diarrhœa are prominent symptoms; the latter in some cases apparently carries off the poison. When anything like sallowness of the skin or jaundice appears, hepatic abscess should be suspected; and, under these circumstances, there will often be pain in the region of the liver. At the same time the reader must remember that a slight degree of jaundice is often present without hepatic suppuration. The urine is rarely altered either in character or in quantity, although at times it is scanty and dark coloured.

Joint complications.

When severe or dull pains are experienced in a joint, suppuration should be suspected; and anything like so-called rheumatic pains occurring in a patient with pyæmia becomes a source of suspicion; "rheumatic" pains in blood-poisoning too often mean joint or bone mischief of a suppurative kind. It is also remarkable how slight the symptoms often are in these cases when severe local disease exists. This fact demands that the surgeon should ever be on the watch to detect anything like local changes; inasmuch as it is a pathological truth that there is no organ or tissue of the body in which suppurative disease may not take place in a case of blood-poisoning or pyæmia; and it is certainly true that the existence of severe local disease is too often only first discovered on the *post-mortem* table.

Pathological conditions.

What then, it may be asked, are the *pathological conditions found after death* in a case of blood-poisoning or pyæmia—using this word in a general sense?

The analysis (shown in the form of a table, page 114) of 203 fatal cases, which I have collected from the records of Guy's Hospital with the sanction of my colleagues Drs. Wilks and Moxon, by whom all the examinations were made, will answer this question.

Pathological Conditions from Pyæmia found after Death.

a. Lungs.

The lungs.—The most prominent fact indicated by this table has reference to the lungs, for it proves that in the larger proportion of fatal cases of blood-poisoning these organs are implicated, and further, that in many they are the only parts involved. Lung mischief was found one hundred and eighty-seven times in two hundred and three cases; while in seventy-eight cases, or thirty-eight in every hundred, the lungs were the only organs affected. *Lobular pneumonia* is the form in which the disease is generally found; and when even a lobar pneumonia is present, it can usually be made out to have originated in lobules, and to have spread from them as centres. This lobular pneumonia, like the lobar form, is also generally seen in the *lower lobes*, and not at the apices; and nearer the surface than the central parts. The earliest indication of disease is a lobular pneumonia, and "subsequently," says Wilks, "these congested spots are found to contain inflammatory products, and thus we have red hepatisation, suppuration or sloughing," all these stages of inflammation being visible in individual masses. Associated with this lobular pneumonia some *ecchymosis* of the surface of the lung will generally be found—a purpuric condition in fact—strongly suggestive of blood-poisoning. Pleurisy, moreover, generally exists, the fact being accounted for by the superficial position of the lobular pneumonia.

b. Liver.

The liver, like the lungs, is also attacked in its lobules, which may be

either congested, inflamed, suppurating, or sloughing. At times it is filled with small abscesses. When these approach the surface of the liver, they may burst and give rise to a general peritonitis. The liver was involved in this affection twenty-seven times in every hundred cases, and almost always in association with disease in the lungs. Thus, out of fifty-five cases in which the liver was affected, in only two were the lungs uninvolved. It would appear, likewise, from the table that the liver is more frequently the seat of pyæmic suppuration after injuries to the head than after any other affection, and that it is rarely found involved after disease of the urinary organs and burns.

c. Kidneys.

The kidneys.—When these organs are affected, they are so in a similar manner to the lungs and liver, and present small isolated points of suppuration surrounded by a zone of congestion either on their surface or in their cortical structure. They are not, however, affected so frequently as are the two former organs—not oftener, indeed, than in seventeen cases out of every hundred, and then mostly after disease of the urinary organs, or suppurative disease of the cellular tissue, particularly of that surrounding the shafts of bones.

d. Other organs.

In the *spleen*, abscesses are often present, and in the *brain, heart, prostate, testis, tongue, thyroid gland*, and, in fact, in any portion of the body they may be met with. In the cellular tissue of the trunk and extremities, as the joints, suppuration is very common.

e. Serous membranes.

When inflammation attacks such serous membranes as the pleura and peritoneum, there is good reason to believe that it is generally due to the extension of disease from the lung, liver, or spleen. In the case of the synovial membrane of the joints no such extension can be made out. The sterno-clavicular articulation is more frequently involved than any other, for I find that out of the twenty-five instances in which joint complication existed, this was involved in eight. Any joint may, however, be affected. In some cases the articulation is only filled with an increase of synovia, in others the contents are puriform—sometimes purulent. At times the pus in the joint appears to be so slightly irritating that the cartilage and the synovial membrane are uninjured by its presence, whilst at others it is so destructive as to produce complete disorganisation, the bones forming the joint being under these circumstances exposed, and at times necrotic. When these changes occur they are, probably, sometimes due to acute articular ostitis.

Joints.

f. Skin.

The skin has occasionally a *vesicular* or *pustular eruption* upon it, and too frequently *purpuric spots* or patches are present, which at times lead on to mortification; and in connection with this subject "we may mention another evidence of the blood disease in the rapid decomposition of the bodies and the marking of the veins on the surface. Thus, before the body is scarcely cold, there may sometimes be seen the blue and red coursing of the veins and the colouring which has exuded from them into the tissues." (Wilks.)

Inflammation of veins exceptional.

Lastly, it is to be noted that it is exceptional to meet with any evidence of *phlebitis*, general or local; and this leads me to consider, although briefly, the now already abandoned and untenable theory that phlebitis, or inflammation of a vein, is the invariable cause of pyæmia.

The most telling evidence against the theory is the one just mentioned, that it is only in exceptional cases of pyæmia that any evidence

ANALYSIS OF 203 FATAL CASES OF PYÆMIA.

Nature of accident or disease.	Number of cases.	Lungs.		Liver.		Kidneys.		Spleen.		Brain.		Heart.		Joints.		Cell-tissue.	
		Cases.	Alone.[1]	Cases.	p. c.	Cases.	p. c.	Cases.	p. c	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.	Cases.	p. c.
Compound fracture ...	26	23	$11_{42\cdot3}$	9	34·6	3	11·5	1	3·8	—	—	—	—	4	15·3	3	11·5
Amputation after compound fracture...	38	34	$14_{36\cdot9}$	15	39·4	2	5·2	6	15·7	—	—	—	—	4	10·5	3	7·8
Amputation for disease	29	24	$14_{48\cdot2}$	6	20·6	2	6·9	2	6·9	2	6·9	—	—	2	6·9	4	13 8
Injury to scalp and skull	11	11	$1_{9\cdot}$	7	63·6	—	—	—	—	5	45·4	—	—	1	9·	2	18·1
Inflammation and suppuration of soft parts	33	30	$9_{27\cdot}$	8	24·2	8	24·2	5	15·1	2	6·	5	15·1	8	24·2	5	15·1
Disease of urinary organs	22	22	$11_{50\cdot}$	—	—	10	45·4	—	—	1	4·5	1	4·5	—	—	1	4·5
Disease of bones and joints	28	27	$9_{32\cdot}$	6	21·4	8	28·5	4	14·2	—	—	4	14·2	6	21·4	2	7·1
Operations on soft parts	5	5	$2_{40\cdot}$	1	20·	1	20·	1	20·	—	—	1	20·	—	—	1	20·
Carbuncle.....	6	5	$2_{33\cdot}$	3	50·	2	33·3	—	—	1	16·6	2	33 3				
Burns	5	5	$5_{100\cdot}$														
TOTAL.....	203	186 or 91·6 per cent.	78 or 38·4 per cent.	52[2]	27·	36	17·7	19	9·3	11	5·4	13	6·4	25[3]	12·3	21	10·3

[1] In which the lungs were alone involved. The small figures show the percentages. [2] The liver was involved alone in two cases only, in all others the lungs were affected as well. [3] Sterno-clavicular in eight.

can be found of phlebitis; and the second is almost equally strong, because "so far from phlebitis being a cause of pyæmia, it is remarkable how often the former occurs without any contamination of the blood whatever; that is, if we can call that phlebitis where we find a vein and its branches quite closed by coagulum or adherent fibrin." (Wilks.) Moreover, "it is a question whether, in those cases in which the veins are plugged or inflamed, thrombosis and phlebitis are not the local, and pyæmia the general effect of the same cause" (Savory)—that is, blood infection. With these views I cordially agree. Phlebitis not pyæmia.

That blood poisoning may take place through veins is certain, although, as I have already shown, inflammation of their coats does not necessarily lead to it; neither is it probable that the absorption of pus, as pus, is the usual cause; for when pus mixes with blood, coagulation is produced, and thus its circulation is prevented. There seems, however, good reason to believe that the fluid portion of pus or of some decomposing inflammatory product may be taken up by the veins and carried into the system, and thus cause pyæmia. The poison may be imported into the general circulation through either a small or large vein, when involved in a suppurating or sloughing tissue; this is a frequent occurrence when the vein is connected with an inflamed or divided bone.

It may be fairly inferred that the *milder forms of blood poisoning*, such as traumatic fever, are caused by the circulation of morbid elements in the blood, which are generated either within the body or imported into it from without; and that these morbid elements are at times carried off, sometimes by the lungs, and at other times by the intestines: that the *more severe forms of blood poisoning*, as pyæmia, are caused by embolism—thrombosis, or blood extravasation, due to the admixture with the blood of some morbid fluid; and that this morbid material originates the changes which give rise to the secondary or metastatic abscesses with which Surgeons and pathologists are so familiar. This view receives much support from the fact, that disintegrating fibrin may be carried from the heart through the arterial system into the smaller vessels of the parenchymatous organs, and give rise not only to constitutional symptoms much akin to those which have been described as being present in pyæmia, but to analogous pathological conditions. This condition is spoken of as arterial pyæmia. Thus in the more common form of pyæmia, abscesses form in the viscera or in other parts; and in "arterial pyæmia" lobular fibrinous changes occur. In the former case secondary abscesses are found after death, in the latter secondary fibrinous deposits; it seems probable also that at times these fibrinous deposits may break down and give rise to abscesses. Theory of pyæmia. Embolism. Arterial pyæmia.

This arterial pyæmia is met with after ulcerative and rheumatic endocarditis; it is, doubtless, the cause of the so-called rheumatic pains that follow scarlet fever; and in rarer instances it gives rise to the embolic plugging of some large vessel, which may be followed by gangrene, or by the formation of an aneurism. On two occasions I have had to remove a leg for gangrene from embolism of the femoral artery after scarlet fever. I have also seen cases of aneurism which have probably been due to the same cause. (Vide 'Path. Soc. Trans.,' 1877.)

Arterial pyæmia is not necessarily fatal. Mild attacks come and go, says Wilks, "the proof being found eventually in the cicatrices and remnants of deposits met with in the organs of the bodies of those who have died with heart disease." The mild forms manifest themselves by pyrexia, prostration, and pains in the joints.

Hence, when a patient dies rapidly from blood poisoning, the only pathological change found in the tissues may be some lobular congestion of the lung, indicating the first stage of pneumonia; when life has lasted longer, red or grey hepatisation may be present; and in a later stage suppuration; these different conditions depending upon the intensity of the disease and its duration. "The first stage of the morbid condition which is produced in the viscera is a coagulation in the vessels, and the last stage is a suppuration." (Wilks.)

In feeble patients who have no resisting power against disease, it is possible that even these pathological conditions may not be found; life being, as it were, suddenly destroyed in the first onset of the blood-poisoning. Under these circumstances no definite post-mortem appearances would be seen beyond, perhaps, a general softening of the viscera, or some purpuric condition.

Duration.

Duration of the disease.—There seems reason to believe that a patient may die in two or three days after the first appearance of the symptoms, and, as a rule, bad cases terminate during the second week. Others go on for six or seven weeks. The longer a patient lives the greater the hopes of a successful issue.

Prognosis.

Prognosis.—In every case of blood poisoning great cause for anxiety exists, it being impossible to foretell its course or its end. In one case, a small dose of the poison will prove fatal, while in another a full dose will be thrown off. The violence of the attack does not depend upon the severity or size of the wound; for a trifling wound is at times followed by urgent symptoms, while a severe local injury may be followed by but few, if any, complications. Indeed, some of the severest cases of blood poisoning are found in those in whom there is no wound.

A robust person, doubtless, has a better chance of recovery than a feeble, and an abstemious one than a drunkard. Where diseased viscera exist, particularly diseased kidneys, the prospects of recovery are small indeed, the capabilities of a patient to resist any diseased action under these circumstances being slight in the extreme. A single attack of traumatic fever may pass off without trouble, but a relapse or a second attack always indicates serious mischief. Rigors rarely occur without suggesting the presence of some secondary deposit or local inflammation. One rigor may pass off and leave no trace of harm behind, but a succession of them is associated too frequently with the gravest local complications, such as secondary metastatic abscesses. These abscesses also, when they occur outside any of the three great cavities of the body, are less dangerous than when they occur in the viscera. Acute pyæmia is always accompanied with great danger; when the disease is chronic there is always more hope.

Comparative frequency after injuries and diseases.

The occurrence of pyæmia in different surgical affections is well shown in the following analysis of cases:

Of 217 consecutive cases of pyæmia 68 or 31·3 per cent. were after compound fractures, of which 24 or 11· per cent. were not amputated, and 44 or 20·2 per cent. were amputated.

26 or 12· per cent. were after amputation for disease.
28 „ 12·9 „ „ after other operations.
21 „ 9·6 „ „ after injury of soft parts without operation.
60 „ 27·6 „ „ after disease without operation.
12 „ 5·5 „ „ idiopathic. 2·9 per cent. puerperal.

Statistics of compound fracture.

Statistics of compound fracture.

Out of 790 cases 192 died, or 24· per cent., 68 or 8·6 per cent. of pyæmia,

Of 184 cases treated by amputation 89 died, or 47·7 per cent., 44 or 23·9 per cent. of pyæmia.

Of 606 treated without amputation 103 died, or 17· per cent., 24 or 3·9 per cent. of pyæmia.

Out of 324 cases of amputation of thigh, leg, arm, and forearm for disease 126 died, or 38·8 per cent., 26 or 8· per cent. of pyæmia.

Pyæmia is thus seen to be three times as fatal after amputation for compound fracture as for disease.

Pyæmia in surgical cases.

Out of 29,434 surgical cases admitted into Guy's during 10 years, there were 1749 deaths, or 5·9 per cent. 203 of these or 11·6 per cent. of the fatal cases were from pyæmia; about one in nine of the deaths arising from this cause.

But of the whole number of cases treated, pyæmia was fatal in one case out of 145.

Statistics of last 5 years ending with 1882.

Recent statistics.

During these years a better result than the above can be recorded· and out of 14,951 surgical cases, of which 847 cases or 5·6 per cent· died, only 42 or 5 per cent. of the fatal cases died from pyæmia; the general mortality of pyæmia in the last 5 years having fallen from 1 in every 145 cases treated to 1 in every 356.

In the *compound fractures* also a like improvement is indicated by the fact that of the 213 cases treated 32 or 15 per cent. died, and only 4 of these from pyæmia.

Of 120 cases treated conservatively 9 cases or 7·5 per cent. died, 1 from pyæmia.

Of 93 cases treated by amputation 23 cases or 24·7 per cent. died, 3 from pyæmia.

Out of 11 double amputations 5 recovered.

Pyæmia not a hospital disease.

But is pyæmia a hospital disease? Does it arise from causes that are generated in a hospital? or is it met with more frequently in a hospital because the class of cases in which it is most prone to occur are there treated? Is it found in private practice.

As an answer to the last question it is only necessary for me to refer to Mr. Prescott Hewett's presidential address at the Clinical Society in 1874, in which he gave the particulars of twenty-three examples of pyæmia occurring in private practice, and in six only after operations, four of which were very trivial.

Sixteen of these were in town and seven in the country, and all were placed under most favorable circumstances.

We know, moreover, that some of the worst cases of pyæmia that are seen in the London hospitals—and I can answer for Guy's—are admitted with the affection.

Under these circumstances it may confidently be asserted, that what is known as pyæmia is not peculiarly a hospital disease, and that it probably occurs after surgical injuries and operations as frequently in private as in hospital practice. It is true that pyæmia often takes its origin in hospitals, but equally true is it that it does so because the class of cases in which the affection is the most prone to occur are there to be found.

Blood poisoning may occur anywhere, in hospitals or in private houses; but it is unfair and unscientific to attribute it without reason or evidence to what has been so wrongfully described as "Hospitalism."

Treatment.

TREATMENT.—An unlimited supply of fresh air, simple nutritious food, and, where a wound or suppuration exists, the most thorough *cleanliness*, are the main points of practice to be attended to in the treatment of every case of traumatic fever or pyæmia. Compared with these, all other means are of secondary importance.

As the disease is due to a blood poison, often taken into the body from without, it is the surgeon's duty to see that the patient's room is well ventilated, that it is neither too hot nor too cold, as both extremes are powerful depressants; that the air circulating through it is free, fresh, and fragrant; that the room is frequently purified by cleansing and disinfectants, large dishes of any disinfecting fluid and cloths saturated with the same being distributed about; solid iodine exposed in a plate to the air is a good disinfectant, and more persistent than some others. Care must be taken that no poison from a drain or closet reaches the room; and that all excretions are disinfected at once, indeed, passed directly into vessels containing disinfecting fluid, such as Condy's, carbolic acid, chloride of lime, or chloralum. The wound should be kept *clean*, and care should be taken that all discharges are allowed a free escape. Dressings, when employed to a suppurating or sloughing wound, should be saturated with disinfecting lotions, and changed every three or four hours. When possible, foul wounds should be irrigated, a stream of warm water containing a disinfectant being allowed to run over the surface. I know of no means so valuable for keeping a wound clean as this. When sloughing of the part is present, charcoal poultices are at times beneficial. Sponges should never be employed where pus exists, but tow or cotton-wool, more particularly the absorbing cotton-wool. Poultices, when emplyed, may be put on tow or oakum, both of which materials, through the tar they contain, being disinfectants.

Disinfectants.

a. In simple cases.

In simple, *uncomplicated traumatic fever*, when it stops within the ordinary bounds, and neither runs on nor returns in any severity, no special treatment is called for. Should restlessness or much pain exist, a sedative dose of chloral, opium or morphia, may be given, either by the mouth, rectum, or skin, and beyond this nothing is needed. In more confirmed cases of suppurative fever, when systemic infection is declared, the vital energies of the patient must be maintained or stimulated, and everything that tends to lower must be warded off; thus the administration of tonic medicine becomes a necessity, the preparations of quinine being the best, but strychnine and iron are likewise of great use. From ten to twenty grains of quinine given at the first onset of pyæmia, and repeated every three or four hours, help defervescence. Stimulants must be administered with caution, and

b. In systemic infection.

Goodhart, 'Guy's Hosp. Rep.,' 1870.

their amount regulated by the wants of the individual case. When the patient's habits have been free, alcohol in one of its forms will be required, even in large quantities; whereas to an abstemious person a very moderate dose will be sufficient. The form of stimulant to which the patient has been accustomed is apparently the best.

Diet. The diet should be as nutritious as possible, but its nature must depend upon the assimilative powers of the stomach. Where milk agrees, no better drink can be given, either alone or mixed with eggs or some spirit; cream may be added at times, or the concentrated Swiss milk; animal broths may likewise be freely used. When meat can be digested it may be given, although sparingly. When a patient refuses food, Liebig's extract of meat, or Darby's fluid meat, may be mixed with the beer or wine without his knowledge. When the stomach rejects nourishment it must be given by the rectum, a two- or three-ounce enema of beef tea and egg being administered every four or six hours. Ice may always be allowed in small quantities, as it gives comfort. When the nervous system is disturbed from want of sleep or otherwise, opium may be given, small doses frequently repeated being better than large. Where enemata are used, laudanum may be mixed with them.

Opiates.

Laxatives. Should diarrhœa exist it must not be checked too suddenly, for in some cases of blood poisoning it appears to have an eliminative tendency; it should be stopped only when telling on the patient's powers. To give remedies, however, with the view of eliminating the poison by the bowel is a rash practice, and cannot be recommended. The sulphites and chlorides, which have been highly praised, do not appear in any of their forms to have any power to neutralise the poison in the blood. The alkaline salts have likewise been strongly recommended "to promote the changing and eliminating of the products of the retrograde metamorphosis of the tissues" (Savory), of which the carbonate of ammonia is probably the best, either given alone or with the liquid extract of bark.

Opening of pus depôts. When secondary abscesses have formed in the cellular tissue and between the muscles they should be opened; but great caution must be observed in dealing with inflamed joints. When the presence of pus can be clearly made out it should be evacuated by a free incision into the joint, and care taken that it does not re-accumulate; to prevent this a drainage tube should be introduced into the cavity, and the joint daily freely washed out with a stream of warm water coloured with Condy's, or some other disinfecting fluid, such as carbolic acid, one part in forty, or iodine water composed of one drachm of the tincture of iodine to a pint of water. Soothing applications should at the same time be employed, poppy fomentations being probably the best.

When acute blood poisoning has set in, it is almost needless to say that amputation of a diseased limb has no influence in checking the disease, nor has the application of caustics or cauteries to a wound; indeed, no local treatment is known by which the formation of secondary abscesses can be prevented. In chronic pyæmia, however, amputation is often of essential service.

How far blood poisoning can be prevented is another question, and as it is an important one it may be considered here.

Exciting causes. As to the exciting cause of the disease nothing is known. It

attacks the healthy as well as the cachectic; those surrounded by perfect hygienic influences, as well as those subjected to the most unfavorable, and it is found in private as well as in public practice. It is true that the cachectic, and those who are subjected to close and unhealthy atmospheres, are the more prone to its attack, and that overcrowding in small wards, bad ventilation, bad drainage, and bad feeding, with every other depressing influence, have an injurious tendency. It becomes the Surgeon's duty, therefore, to ward off, as far as he can, all such influences. In cases for operation, when time is allowed for preparation, the general condition of the patient should be investigated; care should be taken that the excretory glands are performing their functions, and, if not, they should, if possible, be at once corrected. The feeble must be strengthened by tonics and good nutritious food, and the supply of stimulants should be regulated in all. The intemperate man should be brought to see the necessity for moderation, and to know that life cannot long be sustained by drink alone; he must learn also that stimulants are chiefly of value in assisting digestion and the assimilation of nutritious food. *The urine under all circumstances should be examined for albumen;* for although its presence would not deter the Surgeon from performing an operation of necessity, to save life, it would affect his prognosis, and would most certainly influence his decision in an operation of expediency. All patients after operation should be kept in absolute repose, the wounds kept clean, and lightly dressed. Everything that tends to procure rapid union must be considered good, and all that induces or keeps up suppuration bad. Blood-poisoning and suppuration, whether with or without a wound, have a close connection. No one who has been in contact with any infectious disorder, such as erysipelas or scarlet fever, should be allowed to come near the patient; for there can be no doubt that there is subtle connection between these poisons and pyæmia. And, lastly, every cheering influence should be brought to bear on the mind of the patient, as well as on his surroundings; for among the agents predisposing to blood poisoning, mental anxieties and depressing emotions should doubtless be reckoned.

Prophylactics.

Value of stimulants.

Avoid infectious disorders.

HECTIC FEVER.

There can be little doubt that surgeons of former times included under the above heading many cases of what we now call septicæmia, pyæmia, or blood-poisoning; and even at the present time it is an open point as to how far the symptoms which denote hectic fever are due to the absorption of some foreign element into the blood.

That hectic fever is never found except in those who are the victims of destructive organic changes, chiefly of a suppurative nature, is an established fact; and it is in such also that confirmed blood-poisoning generally occurs. The physician meets with this condition in pneumonia, phthisis, empyema, abscess in the liver, kidneys, or ovary; the Surgeon in suppurative diseases of joints and bones, in spinal disease, compound fractures, diffused suppurations, &c. The characteristic symptoms are of a remittent character, and usually appear at least once daily, generally towards evening, but they may occur more frequently. They are not unlike those of ague.

Symptoms.

A paroxysm of hectic may be said to commence with fever, of more or less intensity; the skin will be hot and dry, the pulse rapid and feeble. The face, too, will be flushed in a single patch, and the palms of the hands and the soles of the feet hot and burning. The tongue during the paroxysm may be dry, and great thirst will be present. There will, however, be no brain symptoms, no clouding of the intellect, no delirium. The febrile condition may be preceded by shivering or chilliness, but such symptoms are unusual, and are always followed by *a profuse and exhaustive sweat*. This sweating is indeed peculiar to the affection, for it bears no proportion to the febrile symptoms that preceded it. At the commencement of the disease the febrility may be so slight as hardly to be noticed, and yet the patient on falling to sleep and awakening will be bathed in perspiration. When the disease is at its height the cold, hot, and sweating stages may be easily seen; but when it declines the febrile symptoms will be constant, although aggravated towards night, while the morning "colliquative" sweats gradually become more profuse as life ebbs away.

Fever. Rigors. Sweating.

In the early stage of this disease, *between* the paroxysms, there may be no fever. The tongue, dry during the attack, will be moist and clean, but, towards the close, becomes morbidly red, smooth, and sore, with aphthous ulceration. The appetite and digestive organs are rarely much affected; indeed, they are little altered till the general powers are failing rapidly. The skin, at first supple and moist between the attacks, becomes as the disease progresses harsh, dry, and covered with branny scales. The urine, always scanty and high coloured, is more so towards the close of the disease. The bowels are sometimes constipated, but more frequently loose. Throughout the disease, however, the mental faculties remain unimpaired, even when the bodily powers are reduced to a minimum. During the whole disease sleep is usually obtained between the attacks. Death always ensues from exhaustion, which bed-sores too frequently aggravate.

Treatment.—The removal of the cause of the disease is the only means by which a cure can be effected. As the affection is one purely of exhaustion, the object must be to maintain the strength of the patient in every way by the administration of abundance of simple nutritious food, with stimulants carefully adjusted to the special wants of the case. The former should be given at certain short intervals in small quantities, and the latter in sufficient quantities to aid digestion.

Treatment.

Tonic medicine should always be given, quinine probably being the best, as this drug has, doubtless, a power in checking febrile action, in keeping down the temperature of the body, and in preventing sweats. It should be given in a full dose, five grains in the solid form, before the paroxysm. Iron and strychnine are also valuable drugs, and the extract of belladonna in doses of half a grain or more combined with the tonic is of great value. Diarrhœa, when present, should be checked by astringents, but opium should be sparingly employed, except to relieve pain.

With respect to the removal of the cause of the disease by operation when such is possible, there can be no difference of opinion among Surgeons; for hectic is a proof that nature's reparative powers have

Question of operation.

been found wanting in their efforts to cure the local affection, and under these circumstances the Surgeon's duty doubtless lies in operative interference. If the disease can be removed, this should be done, and delay is almost criminal. Let the source of irritation, or weakness, be removed, and it is wonderful how rapidly the most feeble subject may rally after the operation. If the viscera are sound, good hopes of a recovery may be entertained under apparently the most adverse conditions; but if the kidneys are diseased, the prospects of recovery are feeble.

Moxon, 'Guy's Hosp. Reports,' 1871.—*Wilks*, 'Guy's Hosp. Reports,' for 1861 and 1870.—*Lee*, "On Phlebitis." 'Practical Pathology.'—*Paget and Savory*, 'St. Bart. Reports,' vols. i and ii, 1865-6.—*Virchow*, 'Cellular Pathology.'—*Pick*, 'St. George's Hosp. Reports,' vol. iii.—*Billroth, Dr. Th.*, 'Archiv, für Klin. Chirurgie' (Langenbeck's). B. ii, vi, viii, ix.—*Bristowe*, 'Trans. Path. Soc. Lond.,' vol. xiii. Reynold's 'System of Medicine.'—*Roser*, 'Sydenham Soc. Year-Book,' 1863, p. 192.—*Prof. O. Weber*, 'Berl. Klin. Wochenschr,' 1864. 'Year-Book,' 1864, p. 227.—*Gibson*, 'Brit. and For. Med. Chir. Rev.,' Jan. 1866.—*Callender*, Holmes' 'Syst. of Surg.,' 2nd edit., vol. i.—*Sedillot*, 'On Pyæmia,' 1849.—*Arnott*, 'Med-Chir. Trans.,' vol. xv.—*Braidwood*, 'On Pyæmia,' 1865.—*Gresinger*, "On Leukæmia and Pyæmia," Discussion at Clin. Soc., 1874.

CHAPTER II.

ON ANIMAL POISONS.

POISONED WOUNDS.

On poisoned wounds.

Dissection Wounds.—These are of frequent occurrence, although it is exceptional to find them followed by any seriously ill effects. In common with all wounds, they may be attended with absorbent inflammation, inflammation of the cellular tissue, suppuration, septicæmia, or pyæmia; and feeble or cachectic subjects are more liable to these consequences than the strong and steady. In exceptional instances, however, different results follow, and two forms of the affection may be recognised—the *mild* and the *acute*.

Symptoms of mild form.

"The symptoms in the '*mild*' form partake," says Poland, "more or less of the ordinary character of non-specific inflammation, and scarcely present any noticeable characteristic signs; thus, the local appearances consist in the puncture assuming a defined red aspect, which soon becomes pustular; this bursts, and ends in an unhealthy suppuration; there is surrounding erythema of an erratic form, and inflammation and pain extending along the forearm and arm to the axilla, ending in the enlargement and suppuration of the glands. The constitutional effects consist in febrile disturbance, loss of appetite, diarrhœa, fetid eructations, &c. The prognosis and termination are favourable; and the treatment required is to be based upon general principles."

Symptoms of severe or acute form.

The symptoms of the "*acute*" or severe forms are those of a truly specific disease; the local signs commence by the appearance of a small circular or oval vesicle over the seat of puncture, which soon becomes

turbid, milky, and pustular, and not unfrequently has a defined margin, resembling somewhat that of smallpox. This is generally unattended with pain; but the patient often complains of intense pain in the shoulder and about the axilla, which shoots down the chest. The glands in the axilla are early affected, and seem to act as barriers to the further progress of the poison; they become enlarged, and the surrounding cellular tissue is implicated, with serous effusion; there is erythema and puffy swelling; these extend to the subscapular and pectoral regions, spreading down the side of the chest, yielding to pressure, and imparting a peculiar spongy feel. There is, besides, an œdematous and doughy condition of the arm and forearm, owing to serous exudation into the cellular tissue, which seldom, if ever, passes into suppuration."

Constitutional symptoms.

"The constitutional symptoms are at first those of strong excitement; but these are soon followed by those of extreme depression of spirits and much suffering. Rigors, headache, prostration of strength, vomiting, &c., supervene; and, lastly, all the symptoms of low typhoid fever rapidly set in."

In some cases the absorbent glands are not involved, and death may occur from prostration in the early stage of the disease; in others, suppuration and pyæmia may appear, while in a third, extensive and diffused sloughing of the skin may ensue—all these points being materially influenced by the power of the patient to throw off morbific influences.

Prognosis of acute form.

The *prognosis* in these acute cases must be unfavorable. Travers calculated that one in seven recovers; probably this is rather in excess of experience; but if the patient does not sink during the violence of the attack, his powers will be tried to the utmost by the protracted suppuration.

The inoculation from a recently dead body is more serious than that from an old subject of the dissecting-room, and bodies that have been preserved by chloride of zinc are less noxious than others. The fluids from a patient who has died from glanders, peritonitis, and scarlet or puerperal fever, are far more dangerous than all others. Indeed, there is reason to believe that the contact with such fluids is capable of giving rise to the disease without any local wound or abrasion.

Treatment of poisoned wounds.

Treatment.—To keep the patient alive, and to treat local symptoms as they arise on general principles is the usual method now pursued.

A student when he pricks his finger should at once clean and suck the wound, arresting at the same time the circulation of blood through it for at least a minute, by pressure applied with the opposite hand on its cardiac side. The part may then be closed over, a piece of gutta-percha skin made adherent with chloroform being an admirable application. When the wound is free, and the poison is from a recent puerperal case, some caustic such as the nitrate of silver, chloride of zinc, or even nitric acid may be applied. The first two are probably the best. When any inflammation appears, a poultice should be applied, and the hand raised above the shoulder, and, if there should be any tension of the part, it is to be at once relieved by an incision.

Absorbent or cellular inflammation should be treated by fomenta-

tions, or the application of the extract of belladonna rubbed down with glycerine to the inflamed part. Some Surgeons have faith in the local application of nitrate of silver, iodine, or the solution of the perchloride of iron as a means of arresting its progress. The glands when enlarged should be freely bathed with hot water, and hot fomentations constantly applied. The earliest indications of suppuration ought to be looked for in order that pus may be at once evacuated. Sloughs are to be removed by moderate incisions. Tonics should be given from the first, iron when it can be borne with or without quinine in full doses; ammonia and bark when quinine and iron are inapplicable. Nutritious food ought to be given in abundance, milk being the best drink; stimulants, too, when needed, but always with caution. Country air, as soon as it can be enjoyed, is the great aid upon which reliance may be placed for recovery.

Anatomical or Pathological Tubercle.

Anatomical tubercle.

'Guy's Rep.,' 1862.

This is a chronic skin affection, which is to be met with on the hands of those constantly engaged in making post-mortem examinations. Dr. Wilks, when describing some models of the affection that are to be seen in Guy's museum (Fig. 19), called it "*verruca necrogenica*." In its earlier stages it is not unlike epithelial cancer. "It commences without any evident breach of surface, the parts affected being not those liable to pustules, as the back of the hand or wrist, but the knuckles and joints of the fingers. If the disease should begin with a pustule, the pustule bursts, but instead of healing, a thickening of the cuticle takes place around it, and as from time to time a little fresh suppuration occurs, so the thickening and induration increase. Generally, however, these changes go on slowly, without any preliminary vesication. A warty thickening of the epithelium takes place, which, in course of time becomes of a dark colour, until a kind of ichthyotic condition is produced."

FIG. 19.



Anatomical tubercle.
Model Guy's Mus. 1938.

The disease is local, and unattended by constitutional symptoms. The repeated application of the strong tincture of iodine, acid nitrate of mercury, nitric acid, or what is better the benzoline gas cautery, will effect a cure.

Insect stings.

Insect stings in this country are not very severe, and, unless inflicted in large numbers, are rarely brought under the notice of the Surgeon. Slight fever and constitutional disturbance may follow them in children who are susceptible to external influences, whilst local swelling, heat, and redness, are very marked in others. Should a wasp or bee accidentally be taken into the mouth with fruit, and the base of the tongue, pharynx, or larynx stung, serious symptoms may arise from œdema and swelling of the parts impeding respiration. When this accident happens, scarifica-

tions should be employed with fomentations, but if life be threatened, the windpipe must be opened.

When the tongue or other accessible part is affected the sting should be removed, if possible, with a pair of fine forceps, and thus much pain is saved. Where this cannot be done a drop of either the liquor ammoniæ, sal volatile, or oil of lavender, applied to the part generally gives relief. The parts should also be protected from the air by collodion, flour, chalk, or strapping.

For mosquito bites Dr. J. Stevenson, of Ceylon, advises ('Edin. Month. Journ.,' Feb. 1882) the use of a moist cake of soap. The thin lather from the cake being allowed to dry upon the bitten part. All pain and itching, he states, disappears within ten minutes of this application.

The bite of the scorpion, the tarantula, and other tropical insects is, however, more troublesome, and is often followed by nervous depression, vomiting, and local pain. In South America the mosquito bite is at times attended with severe local inflammation, and sometimes with ulceration. In Africa and Asia the scorpion, which is from six to ten inches long, is so venomous as to cause, by its bite, at times, loss of life. Olive oil is the usual application for the wound, but liquor ammoniæ is probably better. Brandy and ammonia should be given internally when great depression exists.

The bite of the spider is very similar in its effects to that of the scorpion, though the wonderful stories as to its poisonous qualities are now regarded as fabulous.

Serpent bites.

Serpent bites are often serious, and at times fatal, the poison being squeezed into the tissue in the act of biting, from a special apparatus situated at the base of the upper fangs. In England, the *viper* is the only poisonous reptile, and although some local and constitutional disturbance may follow its bite, a fatal result rarely ensues.

The *cobra di capello, rattlesnake, whipcord snake,* and *phoorsa snake* are the most venomous.

In some cases the poison seems to spend its effects upon the nervous system, killing by convulsions or coma; in others, its local effects are the more important.

Mitchell's account of rattlesnake bites.

Dr. S. Weir Mitchell, of Philadelphia, who has carefully studied the effects of poison by the rattlesnake, states that the bite is sometimes followed by pain of a pricking or burning character, which gradually becomes more intense, also by bleeding, swelling, and discoloration of the injured part and tissues around, these symptoms depending upon the effusion of blood into the cellular tissue. The wounded extremity becomes larger and the pain greater, the skin assuming a mottled marbly aspect. As secondary effects, inflammation and disorganisation of the tissues occur; the inflammation assumes more the character of the phlegmonous erysipelas, and is associated with glandular enlargement and suppuration, followed by gangrene as a common consequence.

Great depression of the nervous system and general prostration are the most prominent constitutional symptoms, with profuse cold sweats, vomiting, dyspnœa, and diarrhœa; and jaundice often precedes death.

Prognosis.

When the dose of the poison is large, or the susceptibilities of the patient acute, death may take place at once from general prostra-

tion and local stagnation of blood in the wounded extremity. In the case of a keeper of the London Zoological Gardens, who was bitten in the nose by a cobra death took place in little more than an hour after the infliction of the wound, and half an hour only had elapsed when he was apparently dying, being unable to speak, swallow, or support himself; the pupils became dilated, the face livid, the heart's action feeble, and he was scarcely conscious.

Mitchell has recorded a case which proved fatal in five and a half hours. Of others one died comatose, another with dyspnœa and dysphagia, a third felt sleepy and died without agony.

On the other hand, patients at times recover suddenly, even when the symptoms have been severe, as if the poison had suddenly lost its power. More commonly, however, death ensues, and when recovery follows, it is only after severe local suppuration and sloughing, leaving a maimed and useless limb.

Appearances after death.

After death Mitchell found ecchymoses in the thoracic and abdominal viscera, purpuric in their nature, and clearly caused by a want of the normal coagulating power in the blood; this altered condition of the blood, indeed, is the most common effect of snake poisons, and it is stated in some cases to last through life. Hence, in bites from the Indian phoorsa snake, there is said to be a haemorrhagic tendency during life. After death Mitchell could never detect the least alteration in the blood-cells in acute cases, but in exceptional examples of chronic poisoning he found a few globules indented. In chronic cases, also, where there has been time for the poison to act upon the blood, the want of coagulating power in the blood is very constant, and putrefactive changes rapidly follow.

Dr. Halford, of Melbourne, says he always found the blood after death dark and fluid. It also contained germinal nucleated cells, which he regards as molecules of living foreign matter thrown into the blood from the venom, and he accounts for the asphyxia and death by the increase and multiplication of these molecules, which take place at the expense of the oxygen normally wanted in inspiration.

Sir J. Fayrer tells us, however, that he has never been able to detect these changes in the blood, although the poison affects the blood primarily, and the nervous centres indirectly through it. ('Indian Annals of Med. Science,' 1870.)

Treatment of serpent poisoning.

TREATMENT should be most energetic, otherwise the depressing influence of the poison will soon paralyse all action, a few seconds often being enough for the absorption of the poison.

Local.

Locally, the aim should be to arrest the absorption of the poison by fastening a ligature firmly on the cardiac side of the wound, by excising the wounded part, and by the application of nitric acid, carbolic acid, or the nitrate of silver.

Fayrer records, that the natives of India apply a ligature not only just above the bite, but at several places on the limb at intervals of some inches; they then place a red-hot coal upon the wounded part. The danger and difficulty lie in not applying the ligature quickly enough. The ligature must also be tightened to the utmost, till the circulation is entirely arrested and the part is livid with retained blood. The punctures should then be scarified to allow the blood to flow freely, and the cautery or caustics afterwards be applied.

Constitutionally, the best treatment lies in the administration of ammonia and stimulants in sufficient quantities to maintain the action of the nervous and circulatory systems, and thus to keep the patient alive whilst the poison is being worked off or becomes exhausted; for the man who is dying from snake bites is perishing from rapid exhaustion of nerve force. Any other measure that can rouse and stimulate the failing nervous energy may also be employed. Constitutional.

Fowler's solution in full doses every half hour for four hours is said to have been useful. Iodine has also been advocated, and olive oil internally in full doses has been highly praised. In countries where poisonous snakes abound, different roots have their reputation, such as the guaco, the sacræ vitæ ancora, radix corineæ, decoction of Virginia snake-root, &c. &c.; but Fayrer after repeated experiments, believes them to be utterly useless.

Halford has inferred from his experiments that the injection of twenty to thirty drops of a solution of one part of strong liquor ammoniæ to three parts by measure of water into one of the veins of the wounded limb, accompanied by the local application of liquor ammoniæ to the part, is a specific; but Fayrer, who has tried the practice, has failed to find the success looked for. Mitchell advises ligature of the cardiac side of the wound; or excision, amputation, or destruction by cautery or escharotics of the poisoned part; and even *suction* of the wound immediately after the bite, as the poison has no influence in the stomach. He thinks well also of the injection into the wound of iodine or ammonia, and says the natives believe the local application of olive oil to be the best. M. de Lacerda communicated, in 1882, to the Paris Academy a note, in which he asserts that a one per cent. filtered solution of the permanganate of potash injected beneath the skin or into the veins counteracts very effectively the poison of snakes. With this local treatment, the patient is to be kept up by hope, the action of the heart sustained by stimulants quite irrespective of quantity, and the general powers maintained by nutritious food. By these means, "if the person be not thoroughly poisoned, we may help him to recover. If he be badly bitten by one of the more deadly snakes, we can do no more." (Fayrer.) Injections into veins. Ligature on cardiac side.

Bites of Diseased Animals.

Hydrophobia, meaning the "dread of water," which is more correctly termed "RABIES," is a disease contracted from the bite of a rabid animal, through its saliva or mucus. It appears at all seasons of the year, and is, as a rule, fatal. Hydrophobia.

It is more common in temperate regions of the world than in the torrid and frigid zones. It is unknown in Australia, New Zealand, Greenland, and Kamschatka.

Blaine and Youatt affirm that in animals, rabies is entirely due to a traumatic action, viz. the bite of some rabid creature inflicted on another previously free from the disease. Fleming, the most recent authority, tells us, however, that the virus of rabies may, under certain favorable conditions, be generated directly without the intervention of any infecting medium, although at present we are in complete ignorance of the conditions on which its spontaneous production depends. All animals bitten do not contract the disease, as is proved by Renault of Alfort, who caused dogs, horses, &c., to be bitten several times, and even inoculated

them, when out of 99 cases, 67 contracted the malady, and 32, or one third, escaped. Fleming calculates that 30 or 40 per cent. of people who are bitten by mad animals go mad.

Symptoms in the dog.

In the *dog* there are three well-marked stages of the complaint. The *first* is the *melancholic*, characterised by melancholy, depression, sullenness, and fidgettiness; the *second*, the *furious*, by excitement, or rabid fury; and the *last*, the *paralytic*, by general muscular debility and actual *paralysis*.

Stage of depression.

"The dog," writes Trousseau, "looks ill and sullen after a period of incubation of a very variable length; he is constantly agitated, turning round and round inside his kennel, or roaming about if he is at large. His eyes, when turned on his master, have a strange look in them, expressive of sadness as well as of distrust. His attitude is suspicious, and indicates that he is not well; by his wandering 'he seems to be seeking' for a remedy. He is not to be trusted; if he obeys at all, he does it slowly; if you chastise him he may, in spite of himself, inflict a fatal bite."

Stage of excitement.

"His agitation increases; if in a room, he runs about looking under the furniture, tearing the curtains and carpets, sometimes flying at the walls, at others jumping as if to catch flies; the next moment he stops, stretches his neck, and seems to listen at a distant noise. He probably then has hallucinations of sight and hearing."

"This delirium," says Youatt, "may still be dispersed by the magical influence of his master's voice; all these dreadful objects may vanish, and the creature creeps to his master with the expression of attachment peculiar to him."

Stage of muscular debility.

"There follows then an interval of calm; he slowly closes his eyes, hangs down his head, his fore legs seem to give way beneath him, and he looks on the point of dropping. Suddenly, however, he gets up again; fresh phantoms rise before him; he looks around him with a savage expression, and rushes against an enemy which only exists in his imagination. By this time the animal's bark is hoarse and muffled; loud at first, it gradually fails in force and intensity, and becomes weaker and weaker. In some cases the power of barking is completely lost; the dog is dumb, and his tongue hangs out through his half-opened jaws, from which dribbles a frothy saliva. Sometimes his mouth is perfectly dry, and he cannot swallow, although in the majority of cases he can still eat and drink. When he cannot drink, he will appear to lap fluids with great rapidity, but on looking closely it will be seen that he merely bites the water. He can still, in some cases, swallow solids, and he may then swallow anything that is within his reach, bits of wood, pieces of earth, straw, &c."

Still laps fluid.

"Towards the close of the second stage of rabid fury the dog often breaks his chain and runs away; he wanders about the fields, being seized from time to time with paroxysms of fury, and then he stops, from fatigue, as it were, and remains hours in a somnolent state. He generally dies in a ditch or retired corner, apparently from hunger, thirst, and fatigue."

Veterinary surgeons do not say that he dies from asphyxia, brought on by spasm of the pectoral muscles or by convulsions. The disease runs its course in from five to eight days, and it is the same in the dog, cat, horse, and wolf, from any of which man may become inoculated.

Symptoms in man.

In **man** the disease may show itself at any period from six weeks to a year after the inoculation, although Fleming and Bouley assert that

the incubatory period in man varies from one to two months, and that after the third month the chances of immunity are great. Thamhayn ('Schmidt's Jahrbuch.,' 1859), in an analysis of 220 cases showed that, in 49 the symptoms appeared within a month, in 98 during the second, in 29 during the third, and in 26 during the fourth month; 16 of the remaining cases showing themselves within twenty-six months; two cases only maturing at a period of four and five and a half years respectively. But these cases are always doubtful, and are probably examples of hysterical or *nervous hydrophobia*. Fleming, however, records some striking cases which seem to show that the latent disease may be induced or brought into activity by mental agitation. Period of incubation. 'Rabies and Hydrophobia,' 1872.

The disease may attack the infant at the breast or the aged, the male or the female, and during the incubative stage no disturbance of the general health is usually observed. Van Swieten has pointed out that during this period such a disease as variola may run its course without any modification, two poisons thus coexisting in the same frame.

After the incubative stage has passed, the *first symptom* usually displayed is that of sadness; the victim either not suspecting his complaint, or carefully avoiding mentioning the circumstance. His sleep is disturbed; he is fidgety, sighs deeply, and avoids society; he is troubled by noise; or is very irritable and ill-tempered. The *second stage* will be marked by an aggravation of all these symptoms, but there will be in addition pain in the region of the heart with some irregularity of the pulse. Rigors will soon appear, which, says Trousseau, "are true convulsions of all the muscles of the body;" and lastly, the characteristic symptom of dread of water, not as fluid, however, but as connected with the difficulty of drinking. The sight of water is frequently sufficient to bring on shuddering, yet it is when the patient carries water to his lips that he is seized with the typical terrors. A rabid man is always rational and tries to drink, but the attempt excites terror, and the expression of his inability. His eyes become fixed, features contracted, and his countenance expressive of the deepest anxiety, his limbs shake and the whole body shivers. The paroxysm lasts a few seconds, then subsides, but only to be renewed on the slightest breath of air touching his body, for *hyperæsthesia* is one of the most marked symptoms of the affection. Premonitory symptoms. Second stage. Characteristic symptoms.

During the calm, nausea or even vomiting may appear, and priapism is often a most distressing symptom. Sudden terror of an unknown kind haunts the mind, and imaginary calling of fiends often exists. Dr. Bergerons records a case in which the patient heard the ringing of bells, and saw mice run about over his bed.

In the third and last stage the longing for drink becomes intense, with an increasing inability to take it; the voice becomes hoarse and the mouth full of a frothy fluid. The patient tries to get rid of this by spitting, and then becomes frightened at its results. In some cases he fears that by contact this fluid may propagate the disease. Convulsive seizures increase in frequency and intensity, the spasm of the respiratory muscles threatening life; at last a fatal spasm takes place, and death by asphyxia ensues. Final symptoms.

In the dog, death results from paralysis; in man, it is due generally to asphyxia, and in exceptional cases to exhaustion. Cause of death.

This painful affection rarely lasts longer than four days though it has been *fatal in sixteen hours, and has lasted as long* as two or three Duration of disease.

weeks. Thamhayn shows that 56 out of 202 cases died within forty-two hours, 73 in forty-eight hours, 38 between the second and third days, 19 between the third and fourth days, 7 in five, 5 in six, and 4 in seven days.

Condition of wound.

The seat of wound or cicatrix rarely shows anything unusual. In three or four cases out of a hundred it may be slightly painful, irritable, and inflamed; or the seat of a neuralgic pain, which in some instances is very severe, and of the nature of "aura," as in epilepsy.

Diagnosis.

Diagnosis.—Taken as a whole, there is no disease like hydrophobia. In a certain sense it resembles tetanus, yet the two, in their general features, are unlike. They may, however, occur together, and so good an observer as Dr. J. W. Ogle has published a case of combined tetanus and hydrophobia in the 'British and Foreign Medico-Chir. Review,' 1868.

What Trousseau has called nervous hydrophobia (that is, true dysphagia, brought on by a dread of rabies) may, however, be mistaken for it; "but the sudden invasion of this complaint, generally coming on through the person recalling to mind or hearing the relation of a case of true hydrophobia, and the duration of the dysphagia over the period of four days are amply sufficient to characterise the complaint, and to enable the practitioner to persuade the patient that he is suffering from mere nervous symptoms, which will vanish as soon as he ceases to fear. Besides, in nervous hydrophobia there is dysphagia only, but no general convulsions, the spasm affecting the pharynx alone, while the breathing goes on with regularity."

Marochetti's views.

In the very early period of the disease, during its incubation, Drs. Marochetti, Magistel, Xanthos, and others, have called attention to the presence of pustules or vesicles near the frænum of the tongue, known in Greece as *lyssi*, and they assert, that if these *lyssi* are cauterised, all manifestations of disease can be prevented. Should these observations be confirmed a valuable means of diagnosis as well as of treatment in the very earliest stage of the disease will have been found. These lyssi are said to show themselves at an earlier period in proportion to the amount of poison deposited in the wound. Marochetti made early incisions through the vesicles, and then cauterised the surface with a red-hot iron, with, he states, invariable success.

Pathology.

Pathology.—There are no pathological lesions peculiar to hydrophobia—at least, none such have as yet been described. Mr. Durham, in a case that occurred at Guy's in 1865, carefully examined the cord, prepared after Dr. L. Clarke's method, and found extreme congestion of the grey matter of the cord, and numerous minute patches of extravasated blood in different sections. More recently Dr. Benedikt, of Vienna, has made out that in dogs "the pathological process in this disease consists in acute exudative inflammation, with hyaloid degeneration, which doubtless arises from the exudative infiltration of the connective tissue of the brain." ('Wiener Mediz. Presse,' June, 1874; 'London Med. Rec.,' Sept. 30, 1874.)

Treatment.

Treatment.—In all cases of bites from dogs or animals in which the faintest suspicion of rabies exists, free cauterisation with lunar caustic should be performed. Youatt states that he adopted this practice in upwards of 400 cases, and four times on himself, with complete success, and that in all these there was no doubt as to the dog being mad. With such a result no other caustic need be used; when

this is not at hand, any acid, caustic alkali, or cautery, will suffice. When the escharotic cannot be obtained the part may be excised, a ligature being fastened beforehand on the cardiac side of the wound. Some Surgeons advise amputation.

Mental stimulants, in the way of inspiring hope and removing fear, must be freely administered, and such general treatment as may be needed. No drug has yet been found that has the least influence on the disease, either in preventing or curing it. Dr. Marochetti's treatment of the lyssi is the only one that can claim any degree of success. How far the constant administration of chloroform would influence the disease is a question that has yet to be put to the proof. To prevent asphyxia from taking place, tracheotomy, as suggested by Dr. Marshall Hall, is a justifiable measure, the operation being based on a good theory, although it has never been performed on the human subject. By it the immediate risk of death from asphyxia would be rendered impossible, and time given for remedies to act or for the disease to run its course. It seems that six or seven days is the utmost period for the disease to be in existence. If life can be prolonged thus far, the hope of a good result may be entertained. Anything that can tend to prevent death, and keep the patient alive, is useful. Tracheotomy is one of these means, and deserves trial, wine and food being valuable adjuvants.

When a dog is known to be mad it ought to be destroyed; but when any one has been bitten by an animal in which there is a suspicion but no evidence of madness, it should be kept, although apart from others, and guarded, as time will prove the truth of his condition, and do away with the morbid fear of "rabies" that may have been excited by the injury.

Glanders.

Glanders.

This is a specific disease given to man by inoculation from the horse. Dr. Elliotson first recognised its true nature, and described it under the term Equina. It shows itself in two forms. In one the disease attacks the mucous membrane of the nose and the neighbouring glands, and is then termed "*glanders*." In the other it affects the lymphatics of the body generally, giving rise to tumours or a knotty condition of the subcutaneous glands called "*farcy buds*," and is therefore called "*farcy*."

Varieties.

In man, these two forms are generally found together.

Symptoms.

There is said to be a stage of incubation varying from two to fifteen days from the inoculation, after which febrile symptoms with excitement appear, followed by the specific eruption. The pains in the limbs accompanying the febrile condition are generally associated with tenderness wherever glands exist, and, on examination, some enlargement of these glands will be found. The eruption is very characteristic, being made up of a crop of vesicles, which become pustular, and are very hard, resembling those of variola more than anything else. They are arranged in groups, with inflamed bases, the face, neck, and abdomen being, as a rule, more covered than the extremities; when close together, they become confluent. These pustules, with their indurated bases, then soften down, leaving ulcerated excavated surfaces. They affect the mucous lining of the nose, giving rise to the discharge. Virchow says 'Handbuch.' that "these so-called pustules are really due to the presence of a tena-

Characteristic eruption.

Virchow's view of the pustules.

cious deposit in the corium of the skin, which has much resemblance to tubercle, and microscopically is made up of an amorphous granular appearance mixed with cell-elements, cell-growths, and fat-globules." This opinion is supported by the clinical fact that tubercles in farcy are often found in the subcutaneous tissue, appearing as hard circumscribed blind boils, or more or less diffused swellings. These soften down, and give rise to extensive sloughing of the skin and surrounding parts, and are rarely absorbed. During the progress of the disease soft tumours, not unlike pyæmic cutaneous abscesses, appear about the body, and sometimes attack deeper parts. In the more advanced stages of the disease these tubercles or so-called pustules attack the larynx and the whole respiratory tract, and more particularly the lungs; and give rise to Virchow's pneumonia of glanders, an affection which consists of a series of tubercles beneath the pleura covering the lungs, and surrounded by lobular pneumonic inflammation, as in pyæmia. These tubercles are said to have been found in the testicles, kidneys, pancreas, and joints. When they attack the nose, which they usually do at an early period, and often before they appear in other parts, the secretion from the nose is at first catarrhal, thin, and clear; subsequently it becomes thick, tenacious, and puriform, and is often mixed with blood; but in many cases it is altogether absent or not noticed till a later period of the disease. The face and head often swell from œdema, and present a puffy, erysipelatous, shining surface; the conjunctiva also exudes a thick fluid, glueing the eyelids. The tonsils are frequently involved, and often suppurate. As the disease progresses, the swellings and discharge increase, the inflammation around spreads and becomes gangrenous, bullæ appear on the skin, the constitutional symptoms become typhoid, a low delirium sets in, not unlike that from pyæmia, and death ensues from coma and exhaustion. When the glands and absorbents are involved, as in the farcy form, suppuration and sloughing are superadded to those already laid down.

When attacking the nose.

Constitutional symptoms.

Prognosis.

The *prognosis* of glanders is most unfavorable, since recovery only takes place in the mildest cases of poisoning. The disease in its acutest stage has run its course in three days, and may prove fatal in a week; but in general it lasts for three or four weeks, and in very chronic cases life has been prolonged for months. In chronic "farcy," sloughing glands may leave large sores, which remain open for a long time; occasionally such chronic cases end by an attack of acute disease.

Post-mortem appearances.

The post-mortem appearances have been well described in Poland's article, 'Holmes' System,' 3rd edition, vol. i, in two recent cases, in both of which there was an absence of nasal discharge. One was Dickinson's case, and the other Poland's. The first-mentioned subject died on the twenty-first day. The blood was found fluid, the muscles soft and rotten, the cervical and left parotid glands suppurating, the lower part of the right lung solid with grey hepatisation, its tissues completely broken down and infiltrated with purulent fluid, and the left lung studded with numerous slate-coloured patches of the size of hazel nuts.

The second patient died on the thirteenth day. There was no affection of the lymphatic glands, but suppuration had taken place in the muscles of both calves of the legs, accompanied by local abscesses in other parts of the body, chiefly in the muscles; the joints were free

from suppuration; there were recent patches of lymph on the pleura, and lobular pneumonia in the base of the upper lobe of the right lung, which was in a state of grey hepatisation; throughout the lower lobes of both lungs were smaller hepatised masses; the liver was free from disease.

Billroth lays great stress on the presence of hæmorrhagic abscesses in the muscles as being characteristic of the pyæmia of glanders. Abscess in muscles.

In man, the poison is generally communicated through the nasal discharge from the horse or by the discharge from farcy swellings. Where the inoculation takes place from the latter the disease in man is sure of the character of farcy. It can be communicated from man to man. The poison, to be absorbed, must be applied, as a rule, to a wound or delicate membrane, yet cases are on record where the disease has been set up by wiping the face with unclean hands or cloths. Mode of inoculation.

Youatt states that the disease is not one tenth part so common as it was, and, "generally speaking, it is only found as a frequent and prevalent disease where neglect and filth and want of ventilation exist." Youatt's remarks.

Glanders, writes Dr. G. Milroy ('Trans. Epidem. Soc.,' vol. i) is "a *general* as well as a *propagable* disease; it is extremely apt in some seasons to develop itself in foul, unventilated stables." Its development may, however, be controlled even to absolute prevention by the observance of simple sanitary rules.

Treatment. — To keep the machinery of life going, and to treat symptoms upon ordinary surgical principles, seems to be the best mode of practice, for there is no drug which has any influence on the disease. Abundance of fresh air should be provided, with good but not too stimulating food, accompanied by tonics, such as quinine and iron. Pain should be soothed by sedatives. When the nose is a source of trouble it should be kept clean by washing and by a stream of water passed through the nostril, and rendered antiseptic by iodine, carbolic acid, Condy's fluid, or creosote; nitrate of silver solution, tannic acid, and other more stimulating substances being at times valuable. Where the throat is affected it should be sponged with some nitro-muriatic acid lotion, and a gargle of chlorate of potash should be used. Treatment.

Abscesses and softened tubercles should be opened early and freely, poultices or fomentations being applied to the parts. Perfect cleanliness should, of course, be observed. Early opening of abscesses.

Glanders in the horse, as Mr. Youatt tells us in his book on that animal, is chiefly to be recognised by the persistent *discharge* from the nostril and the singular *hardness* of the submaxillary glands, which become adherent to the bone, from the effusion of inflammatory lymph around them. These glands are not very large except at the commencement of the disease, neither are they hot or tender. Glanders in the horse.

When any doubt exists as to the nature of the disease, a condemned horse or ass would be inoculated with the nasal secretion of the suspected animal, and if the disease be genuine it will be reproduced in a few days.

Equina mitis is a local pustular disease affecting the hands and body of those who dress the heels of horses affected with what Jenner has described as the "*grease*." It consists of an inflammation and swelling of the heels of the horse, attended with the discharge of a thin acrid matter therefrom. It is not unlike ecthyma or vaccinia, but more angry; *the pustules are about the size of a sixpence*; they suppu- Equina mitis.

rate on the third day, dry up about the tenth or twelfth, and form scabs, which leave cicatrices. The disease runs its course, and is to be managed by rest and cleanliness.

Malignant Pustule or Charbon.

This disease has been more common in recent years than it was formerly, and I have seen at least a dozen of the seventeen cases that have been treated at Guy's Hospital during the last ten years. My colleague Mr. Davies-Colley has given an excellent account of it, and M. Bourgeois has fully described it in a work entitled 'La Pustule Maligne et Œdème Malin,' Paris, 1860.

Vide 'Med.-Chir. Trans.,' vol. lxv, 1882.

The disease is doubtless due to a distinct poison communicated to man by direct contact with the body of, or with any material that has been in contact with, a diseased animal. At Bradford, where there was an outbreak of it in 1880, it was termed "Woolsorters disease." At Guy's it is found to occur amongst those who work amongst hides in the neighbouring tan yards. It is found chiefly on the exposed parts of man, such as the hands, forearms, neck, and face. It begins as a small, red, inflamed and itching spot, which in twelve or fifteen *hours* vesiculates, the skin beneath the vesicle appearing as a dry brown or black slough. In the course of the second day, another crop of vesicles appears around the original seat of the disease, which run the same course. About this time the seat of the original disease becomes more swollen, appearing as a defined lump ("bouton"), the parts around being œdematous, and the whole subsequently sloughing. "The raised indurated area with its central blackish depression surrounded by small vesicles can hardly be mistaken for any other affection." In this stage of the disease there is little pain, the slough is always *dry, and there is no pus;* the sloughing spreads from the skin down to the subcutaneous tissue instead of as in carbuncle, from the latter to the former (*vide* fig. 3, Plate I, Frontispiece).

Mode of progress.

Fig. 20.



Bacilli from charbon. Drawn by Dr. F. C. Turner, *Vide* Mr. Davies-Colley's paper.

This disease is usually rapid in its progress, four to nine days seeing its end. It is ushered in with rigors, followed by vomiting and *great* depression; often cold sweats and delirium occur, and the patient dies from the depressing influence of the animal poison before its local effects have had time to work. In young subjects, the prospects of recovery are greater than in the old, and, when the hands are involved, the chance is better than when the head is affected.

By the microscope, straight or slightly curved bacilli are found in abundance along the sheaths of the hair follicles, and about

the border of the eschar (Fig. 20). They are likewise found in the blood as well as in the secretions of the body. In the viscera they are the cause of local sloughs from embolic capillary plugging.

Treatment. TREATMENT.—The disease being at its origin local, should be locally treated, and there can be no doubt that the excision of the inflamed and vesiculated area is the best practice to adopt even in advanced cases. By this method 13 out of the 15 cases in which it was carried out at Guy's were cured, although in 12 the inflammation had spread to the surrounding parts, or had involved the lymphatic glands, and the constitutional symptoms were more or less severe. In less severe cases the destruction of the local disease by the thermo-cautery may be resorted to, or caustic, such as the potassa fusa, as advocated by Bourgeois, or carbolic acid, may be substituted.

Tonics and diffusible stimulants are always of use.

SYPHILIS.

Definition. Syphilis is a constitutional disease, the result of a specific animal poison introduced from without. Like other specific animal poisons, it is, as a rule, propagated by some local inoculation; but, unlike all others, it has, by its subtle influence through the parents, the power of affecting the unborn fœtus and the newly born child. No other blood poison appears to possess this power, at any rate to the same degree, and it is well to bear this important point of difference in mind, for in all other respects there is a strong analogy between all.

Mode of its introduction. The poison once introduced into the system, either by inheritance—*inherited syphilis*—or by some local inoculation—*acquired syphilis*—manifests its presence in its own peculiar way, by the appearance of a somewhat irregular although characteristic chain of symptoms.

Characters. These are uncertain in the period of their manifestation after the inoculation, in the order of their appearance, and in their form and effects, yet they possess their own special features. They are *local* and *general*. They run their course, yet do not eliminate the poison. They may disappear for a time to reappear in some other form. The poison may lie dormant for years, and in healthy subjects show no signs of its presence till some weakening influence has depressed the powers of its victim, and given rise to a local affection in which the practised eye will read with more or less certainty the modifying influence of an antecedent syphilitic affection. The poison has been scotched for a time only, but not killed, and in the weakness of its possessor has reasserted its power. No other animal poison appears to have such tenacity of existence.

Effects. Others produce their specific effects in a definite way and in a regular series of symptoms, and are either eliminated or destroy life; they cease to act and become innocuous after having run their course; their power for harm being exhausted. The poison of syphilis, however, is so subtle that it is tolerably certain most of the secretions of a syphilitic subject are capable of producing the same disease in another; clinical experience having disproved Hunter's opinion that syphilis could only be propagated by the secretion of a primary sore, and Ricord's proposition that "chancre at the period of progress is the *only* source of the syphilitic virus."

Modes of propagation. Indeed, it may fairly be asserted that a healthy woman, marrying a man who has had syphilis but in *whom all symptoms have long disappeared*, may give birth pre-

maturely to a dead fœtus, to a stillborn child, or to an infant that will, either at its birth or within a few weeks subsequently, show symptoms of syphilis, all these results being the effects of syphilis transferred from the father. On the other hand, no such result may ensue. Maternal heredity has a stronger influence than paternal. When both parents are syphilitic the chances of a fœtus being affected are greatly enhanced.

Through semen.

'The semen of a diseased man deposited in the vagina of a healthy woman will, by being absorbed, and without the intervention of pregnancy, contaminate that woman with the secondary (constitutional) form of the disease, and that without the presence of a chancre or any open sore, either on the man or the woman." (Dr. Porter, 'Dub. Journ. of Med. Science,' 1857.)

Through ovum.

A healthy woman marrying a man who has had syphilis, but who has lost all symptoms of it, may, not must, acquire syphilis either through the medium of a blighted ovum, or a series more or less prolonged of stillborn children, or through the medium of the utero-placental circulation.

By suckling.

A healthy woman, giving suck to a child the subject of hereditary syphilis may acquire the disease through some fissure of the nipple, the disease locally and constitutionally manifesting its presence with all the intensity of a primary inoculation.

Through secretion of any sore.

Physiological absorption.

Again, the secretion of any true syphilitic sore, chancre, or mucous tubercle, whether of the mouth, nose, anus, vulva, or penis, is capable of transferring the disease; and the syphilitic poison may probably be simply absorbed by the vessels of a part—*physiological absorption*—without giving rise to any local affection. Hunter believed this, and Lane, Marston, and Lee have published observations that tend to support the theory.

"It should never be forgotten that it is the virus which infects the system, and that the sore is the mere local lesion, and not a necessary antecedent to infection" (Committee on Syphilis, p. 8). "It is impossible to predicate with absolute certainty of any given sore that it will or will not be followed by constitutional infection."—J. Lane.

It should never be forgotten that the poison of syphilis, however introduced into the system, whether inherited or acquired from primary sores or from the secretions of a syphilitic subject, is the same, and manifests its presence in much the same way.

Source of contagion not always made out.

It may be difficult in individual cases to make out the direct source of the contagion; but if we recognise the fact that the virus, however diluted in one subject, may, when introduced into another, behave as if it had been taken from a spreading primary chancre, the explanation of most clinical facts becomes easy.

Summary of the poison.

Syphilis is an animal and a human poison; it is capable of propagation by any form of inoculation from the secretion of any syphilitic to a virgin subject in all its intensity; it may likewise be inherited. Nothing is known of its nature, although its effects are sufficiently familiar.

How, then, it may be asked, is syphilis to be recognised? Is it to be recognised in its primary inoculation, or is it only to be known by its constitutional symptoms?

Can it be recognised by the sore?

It has been already stated that most authorities are agreed upon the fact that there is no form of local sore or chancre that can be said with certainty to be the result of the local inoculation of syphilis.

artilaginous indurated sore (fig. 1, Plate I, Frontispiece), with
indurated glands, there is every probability of syphilis mani-
its presence; and in the multiple, suppurating, non-indurated
there is every probability of no such symptoms appearing.
the first form such symptoms may not, and in the second
y appear. Consequently, as a law, this distinction becomes
value. Indeed, syphilis as a disease can only be known by the
tation of its constitutional symptoms, and not by the inocula- Only known by its constitutional effects.
the same way as smallpox, when propagated by inoculation,
e be recognised by the eruption, and not by the local appear-
sulting from inoculation.

Acquired Syphilis.

red syphilis is contracted through inoculation from a chancre, Cause.
syphilitic mucous tubercle, condyloma, or other syphilitic sore,
the secretions of a syphilitic subject; the secretion of one form
litic sore from one subject being capable of producing a chancre
er form in another subject.
Maury and Dulles have traced it to a "Tattooer" with mucous 'American Journal of Med. Sci.,' Jan., 1878.
using his saliva to moisten the colouring matter employed in
.
ohn Morgan, of Dublin, by experiments, has been led to be-
at "the discharge of a syphilitic female produces on *syphi-*
e sore identical with that produced from the soft sore or
"

inoculation a certain time, which varies from six to twelve Its appearance.
usually elapses before the poison manifests its presence. In ex-
l cases, the symptoms of syphilis may appear within the month,
o] appear for four or more months, but every week that passes
e third month without their manifestation lessens the likeli-
their appearance, and when six months have elapsed without
e symptoms showing themselves, the probabilities of their doing
ry slight.
ifferent forms of syphilitic inoculation will be considered under
of chancre.
ssing, therefore, the consideration of the character of the sore
h the poison of syphilis usually gives rise, with the simple
r that there is positively no specific sore, the constitutional
ns of syphilis now claim attention; and the variety of forms
ame is very striking. They usually show themselves primarily Constitutional symptoms.
e skin in the form of an eruption, or upon the mucous mem-
the alimentary canal, as indicated by sore tongue and throat,
me amount of fever and constitutional disturbance at times
their appearance. This "syphilitic fever" varies according to
ous susceptibilities of the patient.
kin eruption may be only a rose rash, *roseola*, giving rise to a Eruption.
r of the skin, or to a more lasting staining. It may assume the
form, *lichen*; the pustular, *ecthyma*; the vesicular, *rupia*; the
ar, ulcerating or non-ulcerating, or the scaly, *lepra*, or *psoriasis*.
e rare, except in hereditary disease; when present they indicate
tic condition.
ildest form of roscola may last but a few days and disappear, Roscola.
a dusky coppery stain behind of some durability.

Lichen. The *lichen* will soon show the copper tint, and, as it flattens, may become a tubercle, and this a scale, the skin after the desquamation of the scale showing much the same as the macula of the rose eruption.

Tubercle. When the eruption is tubercular at the first, the same series of changes will be seen; the raised, indurated or spongy tubercle, as it withers, usually showing a scale upon its surface, and then flattening down to a macula.

Lepra. The *lepra* and *psoriasis* appear as inflamed patches more or less extensive, as in the non-specific forms, the epithelial scales varying in thickness and the fissures in depth. The psoriasis commonly appears on the palms of the hands and the soles of the feet.

Copper-coloured tint. All these eruptions have a copper-coloured tint, more particularly after their first appearances have faded. But what is still more characteristic is the fact that upon the same subject several forms of eruption are often found together—the macula, papule, pustule, tubercle and scale, passing one into another.

What determines the form of the eruption at its first appearance is not known. Why syphilis in one man should manifest its presence by an eruption of maculæ, in another by a papular or scaly eruption, and in a third by a pustular, tubercular, or ulcerative form is not known.

Carmichael's theory not proved. The theory propounded by Carmichael, that each sort of eruption has its own form of local sore or inoculation, was ingenious, but is not supported by facts, and the generally received opinion is that the peculiarity or power of the infected patient has more to do with these phenomena than the nature of the poison itself. The pustular and vesicular eruptions are more prone to appear in cachectic than in the robust subjects, and an ulcerative action is more likely to accompany, or rather to follow their appearance; the base of the pustule or of the vesicle, and at times the substance of the tubercle, break down, and give rise to a troublesome and spreading ulcer.

Affections of the mucous membrane. As the *outside* skin in syphilitic subjects is attacked by eruptions, simple and ulcerative, so the *inside skin or mucous membranes* is equally involved. "Every form of syphilitic affection of the skin," writes Lee, "has its counterpart in the mucous membrane; but the appearances will be modified by the comparative thinness of the structure, by the absence of cuticle, and by the little disposition these parts have to take on the adhesive inflammation." The mucous tubercle is the more common form, and is found in the organs of generation, tongue, mouth, lips, nose, palate, throat, rectum, and anus, and occasionally in other parts of the alimentary canal. It is known also in the larynx. At times these tubercles break down and ulcerate, giving rise to irregular excavated sores.

Mucous tubercle.

Rhagades. Moist tubercles may appear in syphilitic subjects at any part of the body where two skin surfaces are in contact, associated with moisture. When they are found between the toes they are known as *rhagades*, and when about the orifice of a mucous passage as a condyloma.

Ulceration of throat. **Syphilitic sore throat** may appear as a mere mucous patch upon the surface of the mucous membrane, or at times as an ulceration of this patch, while at others it shows itself as a distinct affection, the throat becoming swollen and of a livid colour, and rapidly passing into ulceration.

Varieties. These ulcers may attack the soft palate, pillars of the fauces, tonsils, or pharynx, and present every kind of appearance, shape, and

character. They may be serpiginous like the trail of a snake, horse-shoe shaped or circular, superficial or excavated with sharp edges, inflamed, sloughing, or indolent. By themselves they are not typical of syphilis, however suspicious, and other concomitant symptoms are required to determine the diagnosis. The mucous patch is the most characteristic. No ulceration is typical, although the sharply cut excavated ulcer is the most unmistakeable. In hereditary syphilis this form of excavated ulcer is rare, though I have seen the perforating ulcer of the soft palate in an infected infant a month old.

Mucous patch.

Syphilitic disease of the tongue is a very troublesome affection, and manifests itself in a variety of ways; it appears more commonly in the form of aphthous and mucous patches, ulcerating or otherwise, but not unfrequently the whole thickness of the organ is infiltrated with the gummatous syphilitic material, either as an isolated nodule or as a general infiltration. When this nodule has softened down and suppurated, a deep excavated sore or fissure may be left, not unlike that of cancer, and when this sloughs or is of a chronic nature, the diagnosis becomes still more obscure. In cancer, however, there is probably a more marked local induration than in syphilis, and rarely a sharp, well-defined edge. The history of the case is, too, very different (*vide* Chapter XII).

Syphilitic disease of the tongue.

The mucous lining of the mouth, lips, nose, &c., is also equally liable to syphilitic disease, either in the shape of aphthous and mucous patches, or of ulceration, not unlike that found on the throat or tongue; indeed the disease of one part of the mucous membrane is the same as that of others, the local appearances and symptoms being modified only by the peculiarities of the part.

Mouth, lips, nose, &c.

In ulceration of the rectum, syphilis bears an important part, and as a cause of stricture it is not rare. When present, the disease usually spreads upwards from the anus, the bowel being in some cases superficially, in others deeply infiltrated and ulcerated. This form of disease is more common in women than in men (*vide* Chapter XVI).

Ulceration of rectum.

Syphilitic disease of the periosteum shows itself in the form of nodes, and rarely as a single node. If the tibia be involved, several swellings exist, and the same occurs in other bones, particularly the cranium. The swelling is merely an effusion of the gummy material beneath the periosteum. When the bones are attacked the disease is mostly chronic, and too often ends in the death of the part, *i. e.* in necrosis.

Syphilitic disease of the peritoneum.

In disease of the periosteum, extreme tenderness and pain with local swelling are the chief symptoms. When the bones are implicated the pain is of a constant aching character, and this is always aggravated towards night, but there is neither such swelling, nor so much tenderness, as there is in the periosteal affection. In disease of the bones of the skull, the dura mater and brain may become secondarily affected.

Symptoms.

It must not be thought, however, that syphilis and its effects are confined to those parts of the body that come under the immediate notice of the surgeon. It is hardly probable that both ends of the alimentary canal should show evidence of the affection, without some part of its intermediate twenty-five feet being implicated, or without some of the compound glands that are associated with it being involved. The pathologist knows this to be the case, and recent research has confirmed Wilks' observation ('Guy's Reports,' 1863), that "the extent of the influence of syphilis is only commensurate with the tissues of the

Syphilitic affection of internal organs.

Wilks' observation.

body," and that "there appears to be scarcely a tissue which may not be affected, and always in one particular and characteristic manner." The internal organs may be affected equally with the external; not only the cranium, but the brain within it, or the nerves; not only the muscles of the limbs and tongue, but the heart; not only the pharynx, but the œsophagus; not only the larynx, but the trachea, bronchi and lungs, also the liver, spleen, and other viscera."

Effects on the system.

"**The peculiar effect of syphilis on the system,**" says the same writer, "shows itself in a disposition to the effusion of a low form of lymph, or fibro-plastic material, in nearly every tissue of the body, occasionally modified in character to a slight extent by the organ in which it occurs. In solid organs or in the interior of the tissues there is found a more or less circumscribed deposition of an albumino-fibrous material, whilst on the surface of the body a similar material may constitute merely the base and border of an ulcer." In the testicle this is well seen (Fig. 21).

FIG. 21.



Half a testicle infiltrated with syphilitic deposit. 2351[56]. Prep. Guy's Hos. Mus.

Pathology of syphilis.

In these observations the whole pathology of syphilis is included, for whether syphilis involve skin, mucous membrane, connective tissue, muscle, bone, periosteum, or a viscus, the same exudation exists, either as an exudation and induration, or as an exudation breaking up with ulceration.

Exudation.

This exudation is the same in all stages of syphilis, in all tissues, in hereditary as well as in acquired syphilis. When the exudation is reabsorbed, a recovery is said to have taken place; when it breaks down, suppuration ensues. When it attacks the external tissues "secondary symptoms" are said to exist; when the internal viscera or the bones are affected, the symptoms are called "tertiary."

Affection of bones and larynx.

In cachectic and feeble subjects, where visceral mischief has a tendency to appear, syphilitic disease of the organ may occur. The bones, if affected, are liable to become necrosed; the larynx, to ulcerate; and the skin, when affected, to suppurate as well as ulcerate. In fact, syphilitic disease in the feeble and cachectic is as liable to be associated with disorganising changes as any inflammatory or other affection. The longer the disease has existed, the greater also is the probability that the viscera and the tissues of the body generally will be involved.

Terms "secondary and tertiary" indefinite.

But in all other respects the effects of syphilis are the same. The virus, as it affects the body in all its different ways, is the same; at all times it is the same; the so-called *secondary* and *tertiary* syphilis are the same, for these terms have no definite signification. They have, I believe, tended to confuse rather than clear the subject, and were framed when the pathology of the disease was but little known. Syphilis is clinically known by certain constitutional symptoms, and pathologically by certain morbid conditions. It may manifest its presence in different subjects in different ways, involving now one tissue,

then another, with no apparent law regulating its action. In one patient a tissue may be involved early, in another late; but the node on a bone, the nodule of lymph on the iris, the indurated gummy tumour in the connective tissue or in a muscle, the puckered nodule of fibrous tissue beneath the peritoneal covering of the liver, the mass of fibre tissue poured out in a syphilitic testicle are all alike. These differ only in their symptoms and effects according to their position, yet whether they occur soon or late after the primary inoculation, is a matter of no clinical importance.

Moxon's views.

"While syphilis is thus unsparingly general in its attacks upon organs, yet it plays over much the same series of organs as other diseases; vulnerable or much-abused organs, which suffer disproportionately from common causes of disease, suffer also in much the same proportion from syphilis, while the thyroid, spleen, capsules, deep-seated bones, and, indeed, generally those parts which are not obnoxious to other 'common' diseases, escape also in syphilis" (Moxon, 'Med. Times,' June 24, 1871). In fact, beyond the local inoculation, syphilis fixes upon or rather attacks an organ much as any other disease, possessing no special predilection for one organ or tissue in preference to another; the so-called secondary and tertiary affections having no real difference, save only in the surgeon's mind.

Treatment of constitutional syphilis.

General remarks.

Treatment.—There is no remedy in the pharmacopœia that can be relied upon as a specific for syphilis, although there are many that have a very beneficial influence in aiding the disappearance of the symptoms; they can, however, do no more. It is indeed, a question whether the disease is really ever cured, whether a person once under the influence of syphilis is not really like one brought under the influence of vaccinia, which means, that his body has been so affected by the poison as to be influenced by it for life. After successful vaccination a second inoculation rarely takes as it does in a virgin subject, and after true syphilis a second attack rarely if ever ensues, Porter's law being tolerably proved, "that the influence of syphilis never returns upon itself, or re-contaminates the source from which it had been derived" ('Dublin Quart.,' 1857). Ricord, Lee, and others have proved that the soft or non-infecting chancre is the only one that can be inoculated with success on the same subject. It is true that in a large number of cases, syphilis appears to be cured, that the symptoms disappear and the health of the patient is re-established; yet it is equally true that in such cases, after the lapse of years, it may be even after a quarter of a century, the existence of former syphilis is again recognised, if the health of the patient is lowered. So long as the powers of the subject who had syphilis remain good, no evidence existed of its presence; but when these failed, the poison reasserted its claim to recognition. It must, however, be stated with considerable confidence that Nature, unassisted by art, seems incapable of eliminating the disease, or of arresting its progress.

On use of mercury.

In former times it was thought that in mercury the Surgeon possessed a specific against the disease, and when all chancres were looked upon as syphilitic, and mercury was administered, a large proportion of supposed cures were recorded, no constitutional symptoms showing themselves.

In modern times, however, when it is known that at least three out

of every four cases of chancres of the penis are local venereal affections and not syphilitic, the real success of the mercurial plan is acknowledged to be less extensive than was supposed; although in syphilis—that is, when the constitutional evidence of the disease is present—the power of mercury in getting rid of the symptoms is indisputable.

Mercury by inunction.

In strong and healthy subjects, therefore, when syphilis is present either in the form of skin eruption, sore throat, or other affection of the mucous membrane of the intestinal or respiratory tract, mercury is beneficial. The best mode of using it is generally supposed to be by inunction, *i.e.* the rubbing in of mercurial ointment, about the size of a nut, or, what is better, of the oleate of mercury, 10 per cent. strength, the size of a pea, into the axilla twice a day, till the gums are touched, and after then only once a day. Dr. B. G. Babington recommended the inunction in adults to the soles of the feet, the rubbing in being performed by the action of walking.

Given internally.

The internal administration in bark of the bichloride of mercury in doses of $\frac{1}{16}$th of a grain three times a day, is a good form of administration, as is also the green iodide of mercury in grain doses twice a day, with Dover's pill. Some surgeons still use the blue pill with opium.

As a suppository.

During the last eight or ten years I have been using the mercurial suppository twice a day, and have been greatly satisfied with its action; the drug acts as well thus as by the mouth, and in no way interferes with digestion or the functions of the abdominal viscera; indeed, I am disposed to think it by far the best mode of administering mercury. I know of no objection to its use. Next to this plan the calomel vapour bath is the best.

Calomel vapour bath. 'Holmes's Surgery,' ed. 3rd, vol. iii.

The most convenient calomel vapour bath, writes Lee, is one which was made at my request by Mr. Blaise. In this apparatus the lamp which sublimes the calomel boils the water at the same time. In the centre of the top, immediately over the wick of the lamp, is a small, separate, circular tin plate, on which the calomel is placed; around this is a circular depression, which may be filled one third with boiling water; the apparatus being placed on the ground and the lamp lighted. The patient then sits over it, with an American cloth cloak or mackintosh fastened round his neck. He thus become surrounded with calomel vapour, which he is generally directed to inhale for two or three separate minutes during each bath. In doing this the patient should not put his head under the cloak, but simply allow some of the vapour to escape from the upper part, and breathe it mixed with a large proportion of common air. At the expiration of a quarter of an hour or twenty minutes the calomel is volatilised and the water will have boiled away—a portion of the calomel being deposited on the patient's body. The patient may then gradually unfasten his dress and put on his night gown, but must not wipe his skin. If he prefers it he may go to bed in the cloak and wear it. The bath ought to be used every night, and five or ten grains of calomel is the quantity that should be evaporated.

'Brit. Med. Journ.,' 1869.

Bricheteau, Lewin, and Sigmond have employed the hypodermic injection of mercury with some success, throwing in 15 minims of a solution of corrosive sublimate, 4 grs. to the ounce of water.

Iodide of potassium.

For feeble cachectic subjects, however, mercury is ill adapted, and for such the iodide of potassium in five-grain doses, gradually raised to ten, or more, will do all that is needful. In London practice it is generally required to be combined with some tonic, such as bark, quinine, or

iodide of iron. The combined use of mercury and iodide of potassium will occasionally be of great value.

When the mucous tracts are involved, the addition of some alkali, such as the bicarbonate of potash, in ten-grain doses, to the iodide is advisable. The additions of the compound spirit of ammonia to the bark mixture is also useful.

When the symptoms begin to yield the treatment must be continued; indeed the effects of the drugs, whatever they may be, should be kept up for at least six months after the disappearance of all symptoms, otherwise a relapse will ensue.

Comparing the effects of the two drugs together, it may be asserted that the mercurial plan of treatment is more applicable to the early than the late symptoms of syphilis; that in cases of relapses, or of late syphilis, the iodide of potassium is preferable, although under both circumstances, in exceptional cases, one plan of treatment will succeed where another fails. When iodide of potassium cannot be tolerated, iodide of sodium may be substituted. Comparison of mercury and iodide.

During the course of syphilis the patient should live well, on simple, nutritious, but non-stimulating diet. Wine and beer should be given in moderate proportions, spirits never allowed, and smoking, as a rule, should be interdicted. Diet.

When mercury is being employed the skin should be kept warm and the feet dry, all sudden chills being bad. When suppuration or ulceration exists in any form of syphilis, mercury is rarely applicable, iodide of potassium combined with tonics is then the best drug, with or without opium. Sarsaparilla has no specific influence in syphilis; it is a pleasant vehicle, but nothing more. Opium combined with other drugs is at times of great value; with mercury it is invaluable; it may be given in small doses whenever the nervous system has been overwrought and there is great irritability of pulse. Opium.

The syphilitic affections of the mouth, tonsils, throat, tongue, &c., are expedited in their disappearance by the local application of nitrate of silver, chromic acid, gr. v to x to the ounce, chlorate of potash, boracic acid, or borax gargle, constitutional treatment should be simultaneously employed. Treatment in affections of the mucous membrane.

The mucous tubercles of the genitals and other parts are most successfully treated by the local application of calomel, which should be dusted over the diseased surfaces through a muslin bag. A good rub with nitrate of silver at times expedites the cure. The parts should be kept well dry. Treatment of mucous tubercles.

Condylomata are not so amenable to the calomel treatment as the moist tubercles; they may, however, be successfully treated by the local application of the chromic acid solution, nitrate of silver or sulphate of copper, by a lotion of bichloride of mercury gr. ij to the ounce of water, or of black wash. When the growths are very fleshy, excision is the best practice. Treatment of condylomata.

In ulceration of the throat iodide of potassium, in doses varying from six to fifteen grains three times a day, is of great value, with the local application of the nitrate of silver in stick or strong solution; a gargle of alum, chlorate of potash, or borax, a drachm to a pint of water, is also good.

In laryngeal disease the iodide must also be given quite as freely; and when ulceration has commenced, and seems to be unaffected by Treatment in laryngeal disease.

general treatment, tracheotomy claims serious consideration, because unless the larynx can be kept quiet, repair will not go on, and, so long as ulcerative disease is present, a sudden spasm of the glottis may occur and render imminent the death of the patient. The operation should, however, only be undertaken when the disease is steadily progressing in spite of treatment, and if it is clear that the larynx will be destroyed as a vocal as well as a respiratory organ unless some steps be taken to stop its progress. Of these steps there are none equal to tracheotomy, for all Surgeons are familiar with the fact that even under the most extreme conditions of disease repair goes on in the larynx directly the tracheal tube has been introduced, and physiological rest is given to the organ (*vide* paper by author, 'Clin. Soc. Trans.,' 1868.)

When tracheotomy advisable.

Treatment of gummy tumours.

In the *gummy tumours* of the tongue, muscles, and cellular tissue, large doses of the iodide with tonics are as beneficial as they are in the *periosteal* affections of syphilis.

Treatment of internal syphilis.

There is reason, however, to believe that in the visceral as well as in other diseases which may be looked upon as the sequelæ of syphilis, or as the result of the cachexia caused by the disease and the remedies employed for its removal, iodide of potassium alone has little influence. Dr. Wilks has shown how the lardaceous and waxy diseases of organs are found after syphilis, and every one knows how little amenable to treatment these affections are. Dr. Dickinson has, however, done something to prove that they are due to a want of alkalinity in the blood, and are to be prevented and, in a manner, cured by the medical use of alkalies. With the same view a non-nitrogenous diet should be allowed.

When iodide of potassium is of value.

During the later period of the disease, when the gummous depositions take place, whether it be visceral, osseous, glandular, or otherwise, iodide of potassium in full doses is of great value. In the sequelæ, in waxy or lardaceous disease, it is of little use, alkalies with tonics being then apparently the best. Upon this knowledge it is probable that the late Mr. Aston Key based his advocacy of lime water and the infusion of sarsaparilla in the syphilitic cachexia.

Hereditary Syphilis.

On hereditary syphilis.

That syphilis is capable of being propagated by hereditary transmission is a clinical fact generally recognised, constituting the main distinction between syphilis and all other animal poisons. To what an extent this influence spreads is still a debateable question. According to some observers, instead of diminishing, the radius of its action appears to be yearly increasing.

Probabilities of transmission.

That the child of a parent who has had syphilis *may, not must*, inherit the disease is generally acknowledged, and, when both parents have been affected, the probabilities of its transmission are, doubtless, increased; but data are still wanting to determine under what circumstances the offspring of such parent or parents is likely to be born healthy.

There is, however, some reason to believe that when the mother is at fault the early conceptions are more likely to be blighted and the later come to maturity; whilst when the father is at fault the first conceptions show few, if any, signs of the affection, the symptoms becoming more marked in each succeeding one, till at last the ovum becomes blighted and the wife constitutionally affected.

The probabilities of the child being affected, as well as the degree of the affection, turn likewise much upon the period of time which has elapsed between the disappearance of the constitutional symptoms in the parent and the date of marriage.

Daily experience proves, however, that a man who has had syphilis and lost all traces of it under treatment, who enjoys good health, and marries a healthy wife, may be blessed with healthy children, in whom no traces of syphilis can be found; but the same experience also indicates that these subjects marrying in a less vigorous condition, or lapsing into bad health, may give rise to diseased offspring.

Effects on fœtus.

A certain number of children, succumb in their mother's womb to syphilis, solely because they are already affected with the disease. At other times the children come into the world with lesions unmistakeably syphilitic; while in the great majority of cases the child who inherits syphilis has at first the appearance of health, and, some weeks after birth, presents signs which betray the evil transmitted to it from its parents, it being usually from the first to the third month of extra-uterine life that syphilis manifests itself in the new-born child. Cullerier, gives a year as the latest time for the disease to show itself.

Symptoms of hereditary syphilis.

With respect to the symptoms of hereditary syphilis, it may be well to assert at the beginning, that, with the exception of the primary inoculation, they are much the same as those of the acquired disease. Affections of the skin are found associated with those of the mucous membranes, bones, or viscera; and these manifest themselves in no definite order.

"Snuffles."

At birth the child may be plump and fat, and for some days appear healthy in every respect. After the lapse of a few days some difficulty in breathing will probably appear, with symptoms of cold in the head, these so-called "*snuffles*" being always suspicious. At this time, if the skin be carefully examined, more particularly about the buttocks and feet, some eruption will be seen. This may be simply a staining of the skin, or a more definite papular, vesicular, or pustular rash; it may be associated with some affection of the internal skin or mucous membrane, mucous patches, or condylomata showing themselves at the anus, about the mouth or within it, around the nose, or other parts. The seat of the eruption is greatly determined by the degree of cleanliness observed, the irritation of dirt and moisture in any locality in syphilitic children being followed by condylomata or mucous patches.

Eruption.

Condylomata.

Fissures at orifices.

The orifices of the nose, mouth, and anus are at times fissured in a very marked manner, and occasionally leave traces of the disease which can never be mistaken, even years afterwards. In the annexed drawing these alterations about the face are most typically shown (Fig. 22).

Emaciation.

When the disease is allowed to run its course the child's general condition suffers, it becomes emaciated and puny, the digestive organs become deranged and refuse to assimilate food, however good; while vomiting and diarrhœa are common consequences. Evidence of starvation soon appears, the skin becomes baggy, and of a peculiar dusky hue; when not covered or scarred with eruptions it may have a jaundiced appearance, and the child will probably die from what is called marasmus, which means wasting from starvation.

When the disease does not run so rapid a course, other symptoms show themselves. *It may be in the skin, bones, eye, ear,* or viscera.

parents *may* be affected by the poison, in a way which cannot be classed amongst any of the ordinary forms of hereditary syphilis as described.

Treatment of hereditary syphilis.

When child is sucking.

Mercurials.

TREATMENT.—To help the disappearance of the symptoms of hereditary syphilis, remedies are of great value, and in an infant showing evidence of any constitutional power the prospects of a recovery are very good. When the child is being suckled, whether the mother shows symptoms or not, I have for many years administered my remedies through the mother, giving her from six to ten or sixteen grains of iodide of potassium with quinine, or other tonic mixture, three times a day, half an hour before the child is put to the breast, and I have been much impressed with the excellent results of the practice. When this process acts slowly I give the child in addition a grain of grey powder, with three or four grains of dried soda every night.

Before this I administered the grey powder and soda twice a day, or rubbed in about ten grains of blue ointment every night on the soles of the child's feet, the abdomen, or the axilla, but I much prefer the practice previously laid down. In young infants the mercurial ointment may be put on the belly-band, and thus rubbed in. As the snuffles disappear, the eruption and mucous tubercles fade, and the child begins to fatten and show signs of progress. The treatment should be kept up for at least a month after the disappearance of all symptoms.

Chlorate of potash.

The chlorate of potash treatment in some instances is doubtless attended with no unfavorable result, strong infants with care and nursing battling through the disease, and possibly eliminating it. But the weaker die, when through more active measures they might probably have been saved. Many apparently hopeless victims of hereditary syphilis become under treatment strong and healthy infants.

Wet-nurse forbidden.

A child with hereditary syphilis should under no circumstances be suckled by any other than the mother, for many a healthy wet-nurse has been inoculated by such a criminal practice. When the mother cannot attend to the child it should be brought up by hand.

Serpiginous ulceration.

Serpiginous ulceration.

Characters.

This is a rare and somewhat singular form of venereal disease. It would seem to be more closely connected with the local suppurating non-syphilitic sore than the syphilitic, for it is rarely if ever associated with constitutional syphilis. It usually appears in the groin or thigh after a suppurating bubo the result of a suppurating, non-syphilitic chancre; the opening in the groin spreading in crescentic patches of ulceration, one part of the sore increasing while a second is healing; when the cicatrix forms it presents a smooth glazed appearance. This ulceration is most obstinate, indeed, medicine appears to have little or no influence on its progress, and it may so spread as to extend over the thighs and lower part of the abdomen, and continue at intervals for years, but wearing itself out at last. I have seen one case in which it spread as high as the umbilicus and as low as the knee. The disease at one time promises to heal, and then spreads without any clear cause. It is often found, too, in apparently healthy subjects, and appears to follow some course of its own that is not yet understood. It should be added that this sore is capable of being inoculated upon the same subject, the point of inoculation taking on the same action.

Capable of inoculation.

Treatment of serpiginous ulceration.

TREATMENT.—Mercury and iodide of potassium appear to have little or no influence on this malady; and if the view indicated by

its course be correct, that the disease is not syphilitic, such a result is only what should be expected. The local treatment of the sore seems to be the most important, and the best practice consists in the local application of some strong caustic, such as nitric acid, carbolic acid, or the cautery, either galvanic or actual, the patient being under the influence of some anæsthetic. The local application of iodoform or of resorcine in solution fifteen grains to the ounce of distilled water should also be tried. Opium in moderate doses is of use, and so also are tonics, but in a general way the subjects of this affection are in good health. In several instances I have found a sea voyage of more value than any other treatment. In three cases the sore rapidly healed after the operation of skin grafting had been performed.

Question marriage after syp

When may a man who has had syphilis marry? is a question which is often asked, and to answer it with any degree of confidence is no easy task, assuming, as I do, that the opinions laid down in these pages are correct, that a man who has once had syphilis can never be pronounced free from its influence, and that the poison once in the body may reveal its presence a quarter of a century after all external evidence of its existence in the form of local disease has disappeared.

A man who has had syphilis may, therefore, when he marries, so affect the ovum of his wife as to cause its death, or produce some evidence of disease or feebleness; or, if the wife be healthy and he himself in good condition and free from evidence of the disease at the time of conception, the offspring may escape altogether, and appear as healthy as that of other uninfected parents. Indeed, it would appear that if a man marries when in robust or good health a year after all evidence of the disease has vanished, he may be the father of a healthy child; but if his general condition fails and he becomes cachectic the poison may reassert its influence and manifest its presence by some feeble or even diseased condition of the subsequent offspring.

When the mother is affected with the disease the same risks are run.

Every parent who has had syphilis runs the risk of giving birth to feeble or diseased offspring; these risks are diminished by the general vigour of the parents, and increased by diminished power. No man should marry so long as the slightest taint of the disease manifests its presence, but if in good health, and free from all evidence of its presence for a year, marriage may be contracted. To ask for a longer delay when such a step is contemplated is unfair and unnecessary; a risk must be run, and the lapse of a longer period will not lessen it.

On inoculatio and syphilisat

Inoculation and Syphilisation.

Ricord was the first surgeon who employed inoculation for diagnostic purposes in venereal affections; and through his experiments he was led to the conclusion, that "a chancre at the period of progress is the only source of the syphilitic virus." As a test of the simple suppurating sore it may now be employed, for a second sore can readily be obtained by inoculating a patient from the pus of his own primary one. Indeed, this process of auto-inoculation may be continued for a long series, but only with any effect from the suppurating sore. In the syphilitic sore no inoculation will take, and in the inoculation of common pus no reaction occurs, or next to none, a simple pustule probably alone appearing.

Clinical f

From these *clinical facts it would appear that* common pus, the pus

from a suppurating non-syphilitic sore, and that from a syphilitic one, are very distinct, including under the term syphilitic any sore that is followed by syphilis.

By inoculation, therefore, a surgeon may fairly determine the fact as to the nature of a chancre, and, under some circumstances, the evidence obtained by the practice may be valuable.

Syphilisation.

Syphilisation originated in 1844 through some experiments of M. Auzias Turenne upon animals to inoculate them with syphilis; and in these he found, that, after a number of inoculations, they became proof against the syphilitic virus. It was followed up by M. Sperino, of Turin, and extensively employed by Professors Boeck, Faye, and Bidenkap, at Christiania, several hundred cases having been treated upon the principle, the object being "to cure syphilis."

Theory thereof.

The theory as expressed by Boeck, "that the syphilitic virus, by continued inoculation, annihilates itself," was practically carried out by inoculating a patient the subject of syphilis with fresh matter from any active venereal sore of any kind till the inoculations failed to take. The inoculations were repeated every three or four days, first on the body, then on the extremities. When inoculation is no longer possible, "the treatment is finished, and the patient has recovered his health."

Boeck's opinions.

Boeck never practised syphilisation until the constitutional symptoms appeared, for, says he, "I cannot double a malady already present, so I am quite certain not to do harm to the patient." Syphilisation is not used with equal success against all cases of syphilis. "In those that have not been treated with mercury, the progress of syphilisation will be regular; the syphilitic phenomena will vanish away, immunity will take place eventually, and recovery be attained with certainty. In those who have taken mercury, syphilisation is not so certainly useful; it ought to be tried; it does often cure syphilis entirely, and at least does good." These are Boeck's conclusions; but I need hardly add, they are not those of British surgeons. The practice has been mentioned and briefly described, but not to be recommended. It has no single advantage, and is certainly loathsome. We are decidedly of opinion, write Lane and Gascoyen, in an able article on the subject, that "syphilisation is not a treatment which can be recommended for adoption. We consider that, even if it could be admitted to possess all the advantages claimed for it by its advocates, its superiority over other modes of treatment, or in many instances over no treatment at all, would not sufficiently compensate for its tediousness, its painfulness, and the life-long marking which it entails upon the patient." ('Med. Chir. Trans.,' vol. 1.)

The treatment not to be recommended.

Vaccino-syphilis.

Vaccino-syphilis.

That syphilis may be transferred by means of vaccination is a fact which must be honestly recognised, although where it has occurred it seems more than probable that something more than the unmixed lymph of the genuine vaccine vesicle had been employed, such as the blood of the vaccinifer; for no one can now well dispute the possibility of inoculating syphilis when the blood of a syphilitic vaccinifer is transferred with the vaccine matter to a non-syphilitic subject. Whether it be possible to transfer syphilis through unmixed vaccine lymph is still an open question. In this country, such a misfortune as a syphilitic inoculation through vaccination has been happily rare,

and only in recent days has the attention of the great body of the profession been directed to the subject. In Mr. Hutchinson's paper, and in the report of the Royal Med. and Chir. Society for 1871, there will be found sufficient material to prove the truth of what has been written; and in Dr. Seaton's 'Handbook on Vaccination,' and in Dr. Ballard's work, all that is known on the subject may be ascertained. References.

Instructions for Vaccinators.—Vaccinate only subjects who are in good health. Ascertain that there is not any febrile state, nor any irritation of the bowels, nor any unhealthy state of skin; especially no chafing or eczema behind the ears, or in the groin, or elsewhere in folds of skin. Do not vaccinate in cases where there has been recent exposure to the infection of measles or scarlatina, nor where erysipelas is prevailing. Vaccination.

Lymph is to be used according to the following instructions:—

(1.) In proceeding to use a charged capillary tube, snip off its two ends; then, from one end of the tube, blow the lymph through the opposite end upon the arm of one of the infants, over the place where the operation is to be performed, having had previously two or three other infants' arms prepared for vaccination. The lancet is then to be loaded from the drop, and inserted into the arms of the children prepared to receive it, but enough is to be left upon the original arm to vaccinate that child. Unless the tube be very copiously charged not more than two children are to be vaccinated from it. The insertion should be made in four spots as herinafter directed. With capillary tubes.

(2.) In operating with a charged ivory point *use no water to soften the lymph*. In this mode of vaccinating the operator should make a few scratches *just through* the cuticle, only sufficiently deep to *damp* the surface with *blood*. These scratches should *be made in four spots*, each covering a surface, at nearly one inch apart. The scratches may be abrasions of the cuticle by fine parallel lines, or by further cross-scratch. The operation may be performed on both arms when the surface available, or the position usually selected, is of limited extent. The operator should proceed with caution and take time. On no account should incisions be made and the point of the ivory inserted into them; and it should be borne in mind that the vaccine virus ought not to reach the subcutaneous cellular tissue. The child should be kept under observation till the spots are perfectly dry, and orders given that the arms *must not be washed*. With ivory points.

(3.) Never either use or furnish lymph which has in it any, even the slightest, admixture of blood. In storing lymph be careful to keep separate the charges obtained from different subjects, and to affix to each set of charges the name, or the number in your register, of the subject from whom the lymph was derived. Selection of lymph.

(4.) Never take lymph from cases of re-vaccination. Take lymph only from subjects who are in good health, and, as far as you can ascertain, of healthy parentage; preferring children whose families are known to you, and who have elder brothers or sisters of undoubted healthiness. Always carefully examine the subject as to any existing skin disease, and especially as to any signs of hereditary syphilis. Take lymph only from well-characterised, uninjured vesicles. Take it (as may be done in all regular cases on the day week after vaccination) at the stage when the vesicles are fully formed and plump, but when there is no perceptible commencement of areola. Open the vesicles How to take lymph.

with scrupulous care to avoid drawing blood. Take no lymph which, as it issues from the vesicle, is not perfectly clear and transparent, or is at all thin or watery. Do not, under ordinary circumstances, take more lymph from a vesicle than will suffice for the immediate vaccination of five subjects, or for the charging of seven ivory points, or for the filling of three capillary tubes; and from larger or smaller vesicles take only in like proportion to their size. Never squeeze or drain any vesicle. Be careful never to transfer blood from the subject you vaccinate to the subject from whom you take lymph.

(5.) Keep in good condition the lancets or other instruments which you use for vaccinating, and do not use them for other surgical operations. When you vaccinate, have water and a napkin at your side, with which invariably cleanse your instrument after one operation before proceeding to another.

With these precautions vaccination may be regarded as a perfectly safe operation. Without them the risks of syphilitic inoculation, although slight, exist. They tell, however, but little against the enormous advantages of vaccination.

Lee, 'Holmes's System,' ed. 3, vol. iii.—*Marston*, 'Med.-Chir. Trans.,' vol. xlv-vi.—*Lane* and *Gascoyen*, 'Med.-Chir. Trans.,' vol. l.—*Bumstead*, 'Edit. of Cullerier,' Philadelphia, 1868.—*Porter*, 'Dublin Quart.,' 1857.—*Lancereaux*, 'On Syphilis,' New Syd. Soc.—*Wallace*, 'On Venereal.'—*Carmichael*, 'On Venereal.'—*Hutchinson*, 'Syphilitic Diseases of Eye and Teeth.'—'Report of Committee on Venereal Diseases,' 1868.—*Turenne*, Académie des Sciences, 1850.—*Boeck*, 'Edin. Med. Journ.,' 1858,—'Dublin Journal,' 1857.

CHAPTER III.

TUMOURS.

General remarks.

In the pre-pathological period, before the minute anatomy of healthy and diseased tissues was understood, and the microscope had rendered intelligible subjects that still rested in darkness, *tumours* had, from necessity, been studied simply in their clinical aspects, and Surgeons, in their attempts to classify them, were guided solely by the most obvious characteristics of the growths, and by their real or fancied resemblance to the natural tissues of the body. As time advanced, more ambitious attempts at classification were made, and the most

Abernethy's views.

important work was that of *Abernethy*, who at the beginning of this century published his 'Attempt to form a Classification of Tumours according to their *Anatomical Structures*.' In that able production he asserted "that the structure of a tumour is sometimes like that of the part near which it grows, and sometimes unlike; that in many cases the nature of the tumour depends on its own action and organisation, and merely receives nourishment from the surrounding parts." He thus gave expression to pathological truths of the greatest importance, and that still remain incontrovertible. The next real

Bichat's views.

advance was due to Bichat, who recognised the essential difference between tumours and the parasitic nature of the cysticercus and echinococcus, although by his followers this parasitic notion was carried out far too fully, for they looked upon cancer as the product of a parasitic growth of entozoa. It was left, however, to Lobstein, of Strasbourg, to embody Bichat's idea, and to give it full expression

which he did by naming those tumours *homæoplastic* which were similar in structure to the natural constituents of the body; and those *heteroplastic* which were composed of products which differ from the normal tissues. Since that time countless workers have been examining tumours and attempting to classify them—one of the most prominent being Lebert, and to him must fairly be attributed the credit of assigning specific elements to specific tumours, each tumour having, in his opinion, a definite structure; cancer was to be known by the caudate fusiform cells that even now are looked upon by some as typical of the disease. This notion of specific elements was very feasible, for it simplified knowledge and induced men to think they had a ready means of deciding upon the nature of any new growth; and had it not been for Virchow it is probable the theory would have long held its ground. In this learned pathologist, however, it found an opponent of consummate power, and as his reasons for disbelieving it are the groundwork of his great book on 'Cellular Pathology and Tumours,' it is well to have them in his own words:

Lebert's views.

"In Germany the doctrine of specific elements has from the first made few proselytes, and now it is entirely abandoned. From the commencement of my career I have been compelled to combat this error, and I believe that at the present moment we are in a position to demonstrate in every direction, that there do not exist in tumours true specific elements which have no analogy with the normal tissues. It is enough for that to remember that the tumour, however parasitic it may appear to be, *is always a part of the body from which it springs*, and that it is not developed in an isolated manner at the expense of some juice, at some one place in the body, by the inherent force of this productive juice. To admit such a mode of development, *de novo*, was possible at a time when it was also believed that entozoa were spontaneously developed in the body at the expense of a liquid or an excretion, by equivocal generation, when no idea had been as yet formed as to how a cysticercus arrived in the abdomen, and there was able to develop itself and grow. There was no other opinion which medical men could then form save that entozoa sprung from animal substances, either from the tissues themselves or from the intestinal mucus (*saburra*). In the present day, when it is known that entozoa always penetrate into the body from without, by a way often, it is true, extraordinary, yet always natural, this analogy can no longer be invoked. This is still more evident since we have come to know that in a free exudation there is no new element produced; that, furthermore, the elements of the body itself have a legitimate origin from father and mother (or, to speak more correctly, from father or from mother, for it is a case of parthenogenesis), so that we must completely abandon the idea that a tumour can develop itself in the body as an independent being. *It is a part of the body*; it is not merely contiguous to it, but proceeds from it and is subject to its laws. *The laws of the body govern also the tumour.* This is the reason why it is not an object of natural history that one can regard as foreign from the elements of the body; it is, on the contrary, to be looked upon as embraced within its limits. . . . Hair may make its appearance and grow at a place where we do not expect to meet with hair. But no one will fancy or believe that feathers will grow in the human body. As a matter of fact there are tumours in man which

Virchow's views

contain hair, and in cutting up geese tumours are sometimes found containing feathers. But if ever a man engendered a tumour with feathers, or a goose one with hair, this would be a production *sui generis*, because the thing produced would deviate from the type inherent to the individual.

Virchow's view's continued.

"*The type which in general governs the development and formation of the organism, governs equally the development and formation of its tumours.*

"There does not exist a new, different, independent type.

"What is established by logic in this matter results also from the direct observations of tumours themselves. This is why I deny that there is any heterology in the sense in which it has been maintained since Bichat's time, or such as was supposed even before then, that is to say, that a tumour could develop itself and exist in the body in accordance with some quite new plan, some new law. I go further: each species of tumour, whatever it may be, answers in its important parts to the elements of the body, the type of which is known, and the capital difference amongst divers tumours resides in this, that tissues normal in themselves appear under the form of a tumour, sometimes in regions where this tissue normally exists, sometimes in places where it does not exist in the normal state of things. In the first case I speak of it as *homology*, in the second as *heterology*.

"Wherever a normal tissue appears at a point which already contains some similar tissue, then as a consequence the new tissue is identical with the old, so that the type of the new production answers to the type of the pre-existing tissue; in this case the new tissue, the tumour, is homologous; when, on the contrary, the new type does not correspond with the old one, when it deviates from the pre-existing type, or that which is the original and normal one of the region, then there is heterology. But this latter has likewise its analogue in the body, only in another part of the body from that in which the tumour is situated.

"We cannot, in my opinion, distinguish tumours according to the tissues, in such a fashion that tumours containing certain tissues are to be regarded as homœoplastic, whilst those containing certain others are to be set down as heteroplastic; quite the contrary, *the same kind of tumour may be, under certain circumstances, homologous, and under other circumstances heterologous.* The same sort of tumour may at one time appear at a point where it is merely the expression of an excessive development of the tissue normally existing at this point, at another time at a place where this tissue is not in existence, and where its development is abnormal and strictly pathological. Let us take an example: a tumour may be formed of cartilage. The cartilaginous tumour is homologous, not because it is formed of cartilage but only if it springs from cartilage, if in this place there is cartilage already. Thus, a costal cartilage may be the point of origin of an enormous cartilaginous tumour: this is homology. But it is also possible for a cartilaginous tumour to be developed in the testis, which contains no cartilage, where this tissue should not be met with; here the same product constitutes an heterology."

On the terms homology and heterology.

Homology and heterology have, therefore, very different meanings as used by Virchow and other writers. In Virchow's language a tumour is *homologous* when it corresponds in structure with the tissue *in which*

it grows; and *heterologous* when it deviates from that structure. A tumour that is homologous in one position may be heterologous in another. On the other hand, in the French and other schools a tumour is *homologous* when built up of elements naturally existing in some tissue of the body; *heterologous* when composed of elements that deviate from the natural structures, these definitions having nothing whatever to do with the position of the tumour. In Virchow's language the terms are relative; in that of other pathologists they have a definite clinical meaning of no slight importance, for homology means innocence and heterology malignancy in a tumour. Virchow, however, admits that his heterologous tumours are suspicious, although *every heterologous tumour is not of a malignant nature.* "There are a great many such tumours borne without any ill consequences, and whose properties are quite similar to those of which the nature is benign. Malignancy follows a certain scale among heterologous tumours, from species to species; and we are able to show how it is manifested more and more strongly—for the most part following two directions. In the first place, heterology is distinguished according to the degree which it attains. The tissues of connective substance have a much nearer relationship existing among themselves than they have with epithelial tissues or with the specific animal tissues. When, therefore, a cartilaginous or bony tumour is developed in connective tissue, or even a mucous tumour in adipose tissue, that is not nearly so heterologous as when an epidermoid tumour is formed in connective tissue, or a tumour of cylindrical epithelium in a lymphatic gland. A cartilaginous tumour which is developed in connective tissue, or in the tissue of bone, is indeed heterologous, but it is not so to the same degree as an epithelial tumour or a muscular tumour would be in the same place. But a still more important circumstance is this, that tumours engender certain liquid substances which we speak of under the name of juice. This is the humour or juice of the tumour of which much has been said."

Virchow's views thereon.

"This parenchymatous juice is sometimes related to the cells, sometimes to the intercellular substance; and accordingly it appears under the form of fluid either intracellular or intercellular, contained in the cells or interposed among them in a liquid state like serosity. Whenever a tumour contains much juice, it gives evidence of more troublesome qualities, and it possesses to a high degree the property of infection. A dry tumour of the epidermoid kind is by far less dangerous than a moist one; a soft cancer is much more to be dreaded than a hard one.

Succulent tumours tend towards malignancy.

"The more a tumour is poor in vessels the less it will extend its infecting action beyond the neighbouring parts; but the more it is rich in blood-vessels and lymphatics, the more it is traversed by the blood and lymph, the more the parenchymatous juices are in contact with the blood, so much the more is the infection likely to become general.

"I give thus an interpretation of facts, but it is in accord with observation. The degree of contagiousness of tumours increases in proportion as they become more rich in vessels, and that alongside the vessels they contain an abundance of liquid materials. Every soft succulent tumour is suspicious, and that just in proportion as it contains many vessels and cells. The more the juice is intercellular and in contact with the vascular stroma of connective tissue, the more the

On contagiousness of tumours.

malignant properties which are manifested by an ever new excitation to the progressive production of the tumour.

"I ought, indeed, to speak more at length as to the nature of these juices, but in truth I do not know what to say upon the subject. The results which chemists have arrived at on this subject have no kind of value. Here the field is open to inquiring and progressive spirits; and I hope that hereafter researches will be undertaken in this direction, and that they may be crowned with success."

But as this is not a work on pathology, I cannot allow myself to enter further into these speculations, and must refer the reader to Virchow's masterly work on 'Cellular Pathology and on Tumours' for a fuller elucidation of the subject.

Tumours regarded in their clinical aspect.

In the sequel I shall regard tumours in their clinical aspect alone, giving their anatomical characters only so far as they illustrate the practical aspects of the subject. All speculative pathological doctrines will be set aside, as tending to confuse rather than to elucidate clinical phenomena, until the day when pathological science shall have so far advanced as to allow of an anatomical classification of tumours being made that will fully dovetail in with that founded on clinical observation. The microscopical anatomy of tumours has been furnished by the pen of my friend and colleague Dr. Moxon.

I propose to lay down here some few pathological points which have an important clinical bearing, and which tend to illustrate the subject of the diagnosis of tumours.

Definition.

'*A tumour may be defined to be a new growth, cystic or solid, infiltrating, separate from, or continuous with, normal tissues. It is an addition to natural parts, and it manifests its independent existence by its disposition to grow irrespective of the part in which it is placed.*

All tumours, with the exception of the hydatid, are made up of one or more of the natural elementary tissues of the body, in a rudimental or morbid state, and in no single example has any extraneous or new element ever been detected.

A mere increase or overgrowth of natural parts is a hypertrophy. Just as the natural body is built up of cells and fibres in one or other of their different forms, so tumours are made up of like elements, although it may be of unequal proportions. Tumours, like the natural tissues, differ, therefore, anatomically according to the nature of the elementary structure of which they are composed; and this again appears to be materially determined by the part of the body in which they are developed.

Deduction.

From this, therefore, a second leading principle may be fairly deduced, viz. *that all tumours partake of the nature of the part in which they are developed, and are more or less made up of the elements which naturally enter into its formation.*

Explanation.

Hence a tumour developed in the stroma of a fibrous structure will probably be fibrous; if connected with bone more or less osseous; and if situated in a gland, it will in all probability partake of the gland structure. But new growths never assume the complicated structure of a fully developed gland, they only in a degree simulate it. Wilks well expresses it when he says that "the great difference between physiological and pathological formations appears to be that nearly all new growths are of the simplest composition, not putting on the form of the complex organs near which they may be placed, but consisting

Wilks' remarks.

principally of cells and fibres." The cells and nuclei of a part, instead of developing into normal tissues, err in their course, multiplying and possibly growing, and "whilst conforming generally with the part in which they are placed in minute structure and composition, yet they more and more widely deviate from it in shape and size." (Paget.)

Paget's remarks.

The practical bearing of these pathological principles is by no means unimportant; because to the surgeon who has once recognised the true position of a tumour, there is a certain amount of probability as to its nature, which will at once suggest itself to his mind. If the tumour is situated in the skin or subcutaneous tissue a strong probability exists that it will be composed of some one or other of the structures of the tissue; thus it may be the sebaceous tumour, which is rarely found in any other position, or, the fatty, for these two materials enter largely into cutaneous structures; or, it may be one of the fibrous or fibro-cellular nature, fibre-tissue existing abundantly also in these parts. Should the tumour be located between the muscles of a part, the tumour will probably be composed of connective-tissue elements, in the form of a sarcoma or myxoma. Should bone, again, be the seat of the disease, some one of the elements of bone will, to a certainty, enter into its formation; the probability of its being an enchondroma, an osseous or a myeloid tumour naturally presenting itself to the mind. And, lastly, should a tumour be present in a gland, such as the breast or prostate, the probability of its being an adenoid or glandular tumour cannot be overlooked; for pathologists now all recognise the fact of the close resemblance of tumours so situated to the natural gland structure. Even in malignant tumours, if modern recorders are to be relied upon, the same principle holds good, for Carcinoma is now generally recognised to be an epithelial growth, and only occurs primarily where true epithelium already exists. Secondary growths can only be produced by the direct propagation of the epithelial cells, which may be transported from their primary seat, either through the lymph vessels, or as embola are carried through the blood-vessels to a suitable place where they develop like the germs of entozoa.

Practical bearing of the pathological principles.

Tumours are either simple or cancerous, innocent or malignant; the simple or innocent approaching, in their nature, to the more completely developed natural structures of the body, even to the perfect glandular; and the malignant or cancerous simulating the more elementary or embryonic. As the normal tissues were formed from a simple cell, and in their higher grades are but a development of that cell or those cells, so the sarcomatous and cancerous element consists in a persistence of the simple cell type or that of the undeveloped embryonic nucleus. The group of cases called "recurrent" must be placed in an intermediate position, for while in their earlier stages they tend to build up embryonic tissue, this subsequently becomes lost in cell proliferation.

Division of tumours into two classes.

In proportion, therefore, to the amount of the embryonic cell element in a tumour its cancerous tendency may be determined, and the greater the proportion of the fibrous or well-developed structure, the greater the probability of its nature being innocent or simple. The more a tumour simulates the natural structure of a tissue or gland, the greater the probability of its being innocent; the more a tumour simulates the undeveloped cell structure, the greater the certainty of its being cancerous; malignancy appearing to diminish in proportion as the cells become more fully developed. As moreover it is in the nucleus of a cell

On the cell elements in tumours.

that the active principle of its growth is to be sought, so it is clear that the more the tumour is composed of nuclei, the more malignant is its nature and the better the formation of the cell-wall the less malignant is the growth.

The nearer a new growth approaches, both in its elements and in the arrangements of its elements or structure, to the complex organs of the body, the greater are the probabilities of its being innocent; new growths under no circumstances equalling the perfection of a true gland tissue.

Infiltrating process in tumours.

Examples.

Simple tumours separate tissues in their growth, but never infiltrate; cancerous, as a rule, infiltrate, and rarely separate. No more important practical point than the above can be adduced to aid the surgeon in his diagnosis of a tumour. A simple or innocent tumour, however long it may be in growing, or large a size it may attain, will never do more than separate the parts between and beneath which it may be developed. The bones may be absorbed by its pressure, but they will never be infiltrated; and the skin may be so stretched and attenuated by its distension as to ulcerate or burst, but it can never be infiltrated with the elements of the tumour. This fact is well exemplified by a close examination of the margin of a cutaneous opening, the result of over-distension; for it will appear as if cleanly cut, or rather punched at its edges, and never thickened or diseased. An intra-cystic growth may project from it as a fungus, and put on many of the appearances of a cancerous tumour, yet the margin of the opening will be free, and not infiltrated. In the cystic tumours of the breast this clinical fact is easily perceivable (Plate V, Fig. 4).

Encapsuled tumours generally innocent.

Simple tumours, by expanding parts, cause the cellular tissue around to become condensed, and to form a capsule; consequently, most of the innocent tumours are encapsuled more or less completely. With the majority of cancerous tumours, however, a very different condition has to be described, for a cancer has the peculiar property of freely infiltrating all the tissues upon which it presses, at its base, round its borders, and upon its cutaneous aspect. As the tumour approaches the surface, the integument first appears to be drawn down to it, and afterwards seems as though glued to its surface (Plate IV, Figs. 1, 2, 3).

Cancer infiltrates skin, &c.

At a later stage, the skin becomes infiltrated with cancerous elements, feeling to the finger firm, fibrous, or tuberculated; and when ulceration has commenced, the edges of the skin are palpably indurated, thickened, and infiltrated with cancerous products (Plate V, Fig. 1). The contrast between these different conditions of integument in the two classes of tumours is most marked and very important, forming a very valuable means of diagnosis in the extreme stage of simple or malignant tumours.

Diagnosis of simple and cancerous tumours.

Simple or innocent tumours affect the patient solely through their local influence. They grow by their own inherent properties, irrespective of the growth of the parts in which they are placed; have little disposition to soften down or ulcerate, and no tendency to multiplication in other tissues, or to involve the absorbents with which they are connected. Malignant tumours not only affect the patient through their local influence, but have a marvellous tendency to multiplication in any part of the body. Through the lymphatic system they involve the glands of the part with which they are connected, while

through the vascular system they spread to other parts. They are prone, also, to degenerate and ulcerate.

When simple tumours are multiple, they invariably are found in the same tissue. When malignant tumours are multiple, they are mostly found in different tissues. Thus, amongst the innocent growths, multiple fatty tumours of the skin are not uncommon; multiple fibromata of the uterus are often seen; mutiple glandular tumours of the breast are met with involving one or both organs; and there are records of multiple fibroplastic or myxomatous tumours. It is not seldom that multiple enchondromatous tumours and exostoses are seen; but in all these instances the tumours occupy one tissue. When sin tumours multiple.

In the malignant and cancerous multiple tumours no such description can be given, for they spread in ever widening circles from the parent tumour, the cell elements spreading locally in connective tissue as freely as the floating blood-cells move through the walls of the blood passages, as a colloid is penetrated by a crystalloid, wandering about in what are called solid tissues. They follow the course of the lymphatics and affect the glands, and at times seem to follow the course of the venous circulation. They recur by continuity of tissue as from constitutional reproduction, and Mr. Moore, in his work on 'Rodent Cancer,' has referred to a case of Mr. De Morgan's, in which, from a cancerous tumour within the skull, some detached fragments, which had sunk in the fluid of the arachnoid, adhered to the spinal cord and grew. They spare no tissue or organ, but invade one and all, without order or law, in their destructive objectless growth. When cancerous tumours a multiple.

All tumours cannot, however, be divided into the *innocent* and the *malignant*, for there are some of an intermediate kind, which in structure approach the innocent, but in habit the cancerous, as they *recur* after removal. They have consequently been called *recurrent* tumours; but, as the habit of recurrence is not the only point in which they approach the cancerous tumours, it is better perhaps to term them *semi-malignant*. Recurrent intermedia tumours.

I propose, therefore, to describe tumours under the following headings:

A. **Innocent tumours**, or those composed of the normal adult tissues. This section includes Lipoma, Fibroma, Chondroma, Osteoma, Adenoma, Papilloma, Neuroma, Angioma, and Lymphoma.

B. **Semi-malignant**, or those composed of embryonic connective tissues, including the Sarcoma and Myxoma. They form a class of tumours which in a measure belong to the one that precedes it, as well as to the one that follows it, since it includes cases, such as some of the myxomata and sarcomata that are very little malignant, and likewise some sarcomata that are very much so. Nor is that all, for it occasionally happens that some innocent tumours become malignant, and lymphomas which are classed as innocent are sometimes quite the reverse.

C. **Malignant**, or those composed for the most part of epithelial structures, including Epithelial and Hard and Soft Colloid Cancers and Rodent Ulcers.

D. **Granulation tumours**, or those composed of granulation tissue, including Follicular, Keloid, Gummata, &c.

E. *Cysts.*

A. Innocent tumours.

Or those composed of the normal adult tissue, vary with the tissues. They are innocent or benignant in that they do not, like cancers, infiltrate the parts in which they grow, but rather separate them, and are a source of trouble more from mechanical than other causes. When they interfere with life, they do so generally from pressure on important parts. They may stretch skin (Plate V, Fig. 2), even to its rupture, but the margin of the skin opening will be uninvolved in disease. In cystic breast tumours this is well seen (Plate V, Fig. 4).

Lipomatous tumours.

1. Lipomata, fatty tumours, otherwise called steatomata, are very common. They are found wherever fat exists naturally in the body; and, as this material is more especially deposited in the integument, it is in and beneath this that fatty tumours are most frequently met with. They occur at all periods of life, from infancy to old age, and are even congenital. They attack the male sex as well as the female but they are three times as common in the latter. They are generally single, but occasionally multiple. I have seen a case in which the whole integument was studded with them, and under these circumstances they are usually small. It is impossible to assign any valid cause for their development, hereditary and accidental influences having doubtful effects. They are troublesome only from their position and the deformity they occasion (Fig. 25), and are at times the seat of pain,

Causes.

FIG. 25.



Fatty tumour of 37 years' growth on arm of woman, æt. 69.

Symptoms.

though such a symptom must be looked upon as an accident due to their position.

Usually encapsuled.

These tumours are, as a rule, "encapsuled;" although in rare cases they are "continuous" or "diffused." This latter variety differs only from the former in that they are made up of smaller globules of fat, and are more dense, while they are more common about the nape of the neck and face than the encapsuled variety (Fig. 25A); the large double chin is an example of the continuous lipoma, and congenital lipomata are

generally of this nature. The encysted lipomata are most common on the shoulder, thigh, and trunk; some are deep-seated, as between the muscles of the limbs, or within the abdomen, or scrotum. Fatty tumours at times shift their position, that is, they drop downwards; several such cases have passed under my notice, in which the tumour has travelled some distance. Such an occurrence is peculiar to this form of tumour, and suffices to fix its nature.

FIG. 25A.



Diffused lipoma of neck.

The *diagnosis* is not usually difficult. If subcutaneous, these tumours are "lobulated" and "encysted," that is, are defined by a distinct boundary, their cyst-wall being formed by the condensed fibro-cellular tissue in which they are developed. To the hand of the examiner the tumour will feel more or less firm, and made up of lobes; when frozen by the application of ice it becomes harder. To the eye the tumour will, on raising it from its base and distending the skin, appear dimpled, and in parts the skin will be quite drawn inwards towards the new growth. If the tumour be deep a doubt may be felt, but, practically, the question is not of great moment, for it only refers to the nature of a simple growth, and not to its treatment. Diagnosis.

TREATMENT. — When no necessity exists for their removal they should be left alone. When large and unsightly, cumbersome or growing, they should be removed by excision or enucleation. A single incision through the centre of the growth is the best and most expeditious method for turning the cyst out of its bed, which can be done readily by the finger. Where the growth is pendulous, the whole should be cut off, leaving enough skin to cover the wound. After the operation the edges of the wound should be brought together by sutures and strapping and supported by steady pressure; rapid union usually follows. Fatty tumours, when removed, very rarely return. Curling has recorded a case, however, in which a recurrence took place, but so much connective tissue was present in that example as almost to remove it from the class of lipoma ('Path. Trans.,' vol. xviii, 1867). I have also removed from the buttock of a lady a lipoma of two years' growth, the size of a fist, having removed from the same part a like tumour twelve years previously. Treatment. Excision. Rarely recurrent.

The "continuous" fatty tumour should never be removed unless under very urgent circumstances. The operation is comparatively formidable, so much dissection being required. In children, however, these tumours may be dealt with. When not to be removed.

2. **Fibromata** are tumours composed of "hard" or "soft" fibrous tissue. The soft being composed of masses of "connective," and the hard of "fibrous" or closely packed connective tissue elements. The "soft" kind are found as outgrowths from the subcutaneous tissue, and frequently in the female external genital organs; they

are known as "fibro-cellular growths." They are met with also in the lower extremities under the form of "molluscum fibrosum" (*vide* Fig. 26).

FIG. 26.



Case of molluscum fibrosum. Mr. Davies-Colley's case.

Some contain much fat and thus approach the lipomata. These tumours are mostly outgrowths, and appear as the softer polypi and cutaneous pendulous tumours. The polypi of the nose are the best specimens of the looser kind of growths, as in consistence they vary from a watery pellucid pendulous outgrowth to a firm, more compact, and fibrous tissue. They are, however, always covered with mucous membrane with its ciliated epithelium. The softer tumours of the antrum are also of the same nature, as are the mucous polypi of the uterus, bladder, and rectum. In the rectum the tumour is intimately mixed with the glandular elements of the part. Amongst the outgrowths of the integument those of the male and female genital organs are the commonest. The tropical elephantiasis scroti is of this class. The pedunculated outgrowths of the skin are also of the same kind.

Generally rare.

Deep-seated tumours of this nature are very rare. They do occur, however, in the connective tissue of the body, the intermuscular spaces of the thigh and arm being the commonest seat.

Always encapsuled.

They *are always surrounded by a capsule*, and, when not confined by unyielding parts, are more or less ovoid; at times they are lobed. They possess a smooth outline as well as an elastic feel; some of the softer kinds, indeed, give the idea of fluid.

Usually adults.

They are tumours of adult life, being rarely met with in children.

May undergo changes.

They increase in size with variable rapidity, the amount of fluid they contain materially affecting this feature. The pendulous outgrowths, mucous or cutaneous, at times swell out and at others contract, while those of the skin appear shrivelled and loosely encapsuled. Those of the genital organs may attain a very large size, some which are on record having weighed as much as forty pounds. At times these tumours inflame, slough, or ulcerate in an indolent but in no way a typical manner.

The "firmer" kind are met with in many shapes. They are always solid and mostly encapsuled. When, as in the uterus, mixed with the non-striped muscular fibre, the growth is known as "*fibro-muscular*," or as a "*myoma*" (Virchow's term). When associated with cysts, it is called "*fibro-cystic*," and when with calcareous matter "*fibro-calcareous*." These varieties are found chiefly in the uterus.

Varieties.

Fibrous outgrowths.

Fibrous *outgrowths* or *polypi* are commonly met with in the uterus, nose, pharynx, and rectum. They have been found in the intestine and other parts. Fibrous tumours are found likewise in the uterus and prostate, and *occasionally* in connection with the bones and periosteum; in the latter as an epulis. In those about the bones the elements of bone or cartilage are usually found.

us outgrowths have no capsule, but are continuous with the which they spring, and are made up of fibre tissue more or packed and arranged in bundles or in concentric circles; t feebly vascular. Those of the uterus are the most typical

Fibrous outgrowths are not encapsuled.

umours are always encapsuled, and have a tendency to assume globular form when d, but when com- ound down by sur- arts, they take an bular shape. In ey are very similar rowths.

Fibrous tumours are encapsuled.

Characters.

Fig. 27.



Fibrous tumour.
Drawing 397[32], Guy's Hosp. Mus.

tumours are firm, ually most unyield- are slow in their in- give pain only from ion. When bound dense fascia or ear a nerve they h distress. They fere with life or echanically. They single, except in and when in con- th the nerves. As under the notice rgeon, those con- the periosteum or d *periosteal sar-* the most common, the bones the jaws ost frequently af- them. They are iosteal and appear ths (*vide* Chapter s of Bone). They in the pharynx, on the lobule of the ear, and on the nerves nata."

Situation.

utaneous fibrous tumour is a hard movable tumour beneath It is usually small, but when of a less dense kind and more roaching the fibro-cellular tumour, it may attain a large er these circumstances the skin will become part of the will then often ulcerate and allow the growth to protrude e opening and ulcerate or even slough, and thus these metimes bleed freely. At times fibrous tumours seem to the deep fascia.

Subcutaneous fibrous tumours.

is the only treatment which offers any prospect of success. hese fibrous tumours are removed a recurrence is rarely met fibro-muscular, fibro-cystic, and fibro-calcareous tumours uterine.

Treatment of fibrous tumours.

Iromata, *or cartilaginous tumours*, are most commonly met *nection with bone, but they are found* in the parotid or sub-

Enchondroma.

maxillary regions, the soft parts, as the testicles, intermuscular septa, and other parts.

Usually in young persons.

They appear, as a rule, in young subjects, in people under middle age, and are far more common, according to my own notes, in the female than in the male. They are usually slow in growth, the majority having existed years before the patient seeks advice. The instances of tumours of rapid growth on record are rare. These tumours, when

Are encysted.

not outgrowths, are always encysted, and have a smooth, tense, and elastic feel. In some examples they are uniform and even, in others bossy and nodulated; they rarely cause pain, and produce anxiety

Those in the parotid region.

simply from their position and size. Those in the parotid or submaxillary region appear to grow superficially, and to be movable; but they often dip down deeply into the tissues, and considerable care is required in their removal. In a case of my colleague's, Mr. Durham, the tumour appeared more as a pharyngeal than as a parotid growth. As often as not they are very adherent to the surrounding parts. These simple parotid tumours rarely involve the facial nerve or cause paralysis, as do the cancerous. When the cartilaginous tumours grow *within* bones they expand them into a thin shell.

Characters.

Cartilaginous tumours are usually innocent, and consequently only separate the parts between which they are developed. They never involve the integument by infiltration, but only stretch it; in exceptional instances they excite inflammation and ulceration in the skin, with subsequent perforation; they do not affect the system through the glands, although it must be added that rare examples are on record in which cartilaginous tumours have returned and affected the lymphatic system like a cancer. Sir J. Paget has recorded such an instance in the 'Med.-Chir. Trans.,' 1855, and De Morgan in the 'Path. Trans.,' vol. xx.

FIG. 28.



Section of an enchondromatous tumour expanding metacarpal bone.

Appearance on section.

The section of a cartilaginous tumour is fairly characteristic (Fig. 28). It cuts crisply and presents a smooth surface; it may appear of one mass, or made up of many lobules. In some cases the consistence of the tumour is close, and is composed of translucent or bluish masses of fœtal cartilage, as is best seen in the periosteal forms. In others it is loose and granular, as in those expanding the bones. In many of them, fibrous or glandular tissue is intimately mixed with the structure of the tumour, the parotid tumour affording the best type of this kind. In the cartilaginous tumours of bone, bone elements are always present; in those of periosteum, fibrous elements; and where glands are involved, glandular structure. When cartilaginous tumours soften down cysts are found, usually containing a dirty brown serous fluid, or simply filled

with broken-down tissue and pus, or with a more tenacious synovial kind of fluid.

Microscopically, cartilaginous tumours present diverse forms, simple foetal cartilage-cells, embedded in some cases in a hyaline or in a granular matrix, in others in a fibrous or glandular stroma, or even both in different parts of the same growth. The most typical form is that in which the cartilage-cells are grouped together in masses, surrounded by fibre tissue. From this type great deviations occur, the cells being more or less scattered between the fibres. In some instances the nuclei of the cells are free and numerous, in others they are filled with granules or oil-globules, apparently degenerating. Occasionally, the cartilage-cells are developing, and take on the mature form of bone-cells (Fig. 38). Under the microscope.

TREATMENT.—The removal of the cartilaginous growth is the only efficient treatment, but the practice must be determined by the position of the growth and all the other points with which the tumour is clinically surrounded. When removed, a return rarely takes place. Cases, however, are on record (the Guy's Museum containing a few), in which a return ensued after a second or third excision, but such instances are exceptional. Treatment.

The cartilaginous tumours of bone will be considered under the head of Diseases of Bone.

4. **Osteomata or osseous tumours** naturally come to be dealt with after the cartilaginous, for the two elements are usually combined; and, as in the enchondromata, traces of bone may be found, so in the osseous tumours traces of cartilage may exist (Fig. 38). Osseous tumours.

These are found in several forms, as exostoses or bony outgrowths, as ivory or periosteal exostosis and as tumours of bone. The ivory growth is peculiar to the bones of the skull. Two forms. Ivory.

The cancellous exostosis is almost always developed through cartilage, and made up of tissue precisely similar to the cancellous tissue of bone. In some cases it is covered with a thin casing of compact bone, like the cartilaginous tumour growing within a bone, but in most it is covered with a layer of cartilage, by the ossification of which it grows. A diagram illustrating these points will be found in the chapter dealing with exostosis, and the clinical aspect of the subject will be again considered in the chapter on Tumours of Bone. Cancellous.

5. **Adenomata, glandular or adenoid tumours**, are new growths simulating more or less perfectly the gland structure in the neighbourhood of which they grow, and are not hypertrophies of the gland, but distinct tumours. In the breast the usual innocent tumour of the organ is of this nature, and is called *adenocele*, but it is also found in the prostate, uterus, lips, tonsil, thyroid and integument. Fig. 39 represents admirably the microscopical features of the adenomata as a class, and Fig. 29, and Plate VI, Fig. 2, the appearance of such a tumour in section, some parts being solid and others composed of pendulous intracystic growths. On glandular or adenoid tumours. Situation.

They are generally growths of young life, and are found during the active period of a gland's existence. They are always encapsuled, and can usually be turned out of their bed with ease on dividing the capsule. They generally assume a rounded or ovoid shape, and are distinctly movable beneath the integument which is not involved. "On section," says Paget, "they commonly appear lobed, or intersected with partitions of connective tissue, and are pale, greyish or yellowish-white; in some Characters. Encapsuled. Appearance on section.

growth, particularly at first, and destroys life only after many years, and from local causes. They return either in the spot from which they originally sprang, or from its immediate neighbourhood. They simply affect the part mechanically, by separating and surrounding tissues, but never by infiltrating them. The skin is stretched over the tumour, but never involved in it; and if destroyed it is by ulceration from over-distension, while the absorbent glands are never secondarily involved, even in extreme conditions. Such tumours are to the hand more or less fibrous and lobulated, their fibrous feel being much influenced by their rapidity of growth. When cut into, they present a more or less compact surface, a clear serous fluid infiltrating its meshes; while even the finest microscopical section will be found tough and tenacious, and incapable of being pressed into a diffluent mass. Under the microscope they present an excess of nucleated cells and nucleated fibres, these, again, showing their tendency towards the characters of the malignant growth.

Appearances on section and under the microscope.

When originating in fibre tissue and bone.

When a sarcomatous tumour springs from periosteum, it is often separated into sections by bands of fibres; and, when it originates in bone, it may be similarly divided by thin plates or outgrowths of ossific matter; these plates or laminæ being sometimes distinctly separate, at others so closely packed together as to form something like a skeleton tumour (Fig. 30), the sarcomatous elements clothing the bony out-growths, or surrounding and covering them in. For diagnostic purpuposes the detection of these bony plates is of great value.

FIG. 30.



Sarcoma of bone. (Prep. Guy's Mus.)

The treatment of recurrent tumours need not differ from that of the innocent, for as long as the disease is local, there is a reasonable hope that it will at last cease to recur after removal.

Myeloid or giant-celled sarcomatous tumours, are as primary growths generally found associated with bone, either growing from the bone as in "epulis," or more commonly in the bone, and when in this position usually in its articular end. The term was given to the class by Paget on account of the likeness between its cells and those of fœtal marrow. Lebert called them "fibro-plastic," and Virchow "giant-celled sarcoma."

Seat.

Characters.

When these tumours are periosteal they have the clinical features of a fibrous growth; when within the bone, they appear as chronic expansions of the articular extremity or shaft. When large and so expanded as to have burst through their osseous case, they appear cystic

and semi-fluctuating—even to the extent of being pulsatile. They are usually slow in their progress, and often painless, and it is fair to suppose that many of the cases of cystic expansion of the articular extremity of a bone are due to myeloid disease. The disease is one of youth and young adult life; and the growth is usually single. It is not connected with any cachexia or glandular enlargement, as happens with cancer, and when removed it rarely returns. Instances of recurrence, however, have occurred, and I have seen one. Sir J. Paget has recorded others.

Appearance on section.

A myeloid tumour presents in section a peculiar appearance. It may be solid or cystic in variable degrees; osseous matter, fibrous matter, or fluid may exist in different proportions; yet in every specimen the cut surface will present blotches of a pomegranate crimson or of a darker blood colour, these tints mingling more or less regularly with those of the other tissues.

Microscopic characters.

Under the microscope the characteristic polynucleated cells are seen; these are large, round, or irregular cells containing many, even ten or more, oval, well-defined nucleated nuclei floating in a clear or granular substance. They are found in masses or distributed throughout the tumour between the bundles of fibre tissue. They are diagnostic of myeloid disease. With these cells Lebert's caudate or spindle-shaped cells are also found (*vide* Fig. 41).

On melanot sarcoma.

Situation.

Their peculiarity.

Melanotic sarcoma is essentially a tumour containing pigment, having its origin in a natural tissue, as in the choroid of the eye, or in a mole, in which pigment exists; but what it is that determines the development of these growths in tissues that have had a lifelong existence remains to be explained. The black sarcomata have, however, one peculiarity, and that is in their tendency to multiplicity. In this they are often most remarkable—the skin and subcutaneous tissues at times become studded with melanoid growths of all sizes and shades and colours. Fig. 31 is taken from a woman over whose whole body

Fig 31.



Melanotic sarcoma. (From Model, Guy's Mus.)

melanotic cancerous tumours were distributed, the disease having originated in a mole which I had previously excised.

Pathology.

If it were necessary to adduce a forcible illustration of the fact that a tumour when first developed in a part partakes, in a measure, of the nature and peculiarities of that part, and even when repeating itself in

the lymphatic glands and internal organs, still preserves the characters which it originally acquired from the seat of its primary development, no better could be adduced than that derived from the natural history of primary and secondary melanotic growths; for a melanotic sarcoma always grows from a part which naturally contains pigment, and a mole is unquestionably its commonest seat, while pigment in some of its forms is almost always to be met with in all its secondary growths. It may be, perhaps, that the secondary glandular enlargements in their rapidity of growth, outstrip the tumour from which they originally imbibed their peculiar nature; nevertheless, their true character is maintained and preserved to the end. This sarcoma, as a rule, is of the soft form, and runs a very rapid course; an extreme example of melanotic sarcoma, indeed, presenting all the worst features of a cancer. In rare examples of this disease the melanotic pigment may be found in the urine. (Fagge, 'Path. Soc. Trans.,' 1876.) It, has, however, peculiarities of its own, to which attention will be subsequently directed.

Situation.

Osteoid cancer.

The *osteo* sarcoma and chondro sarcoma will receive attention in the chapter devoted to the tumours of bone (Chapter XXXII). They are all probably only modifications of the medullary cancer affecting bone; although it may be mentioned that exceptional cases are on record where an osteoid cancer originated in some intermuscular interspaces.

2. Myxoma.

These tumours are very like the soft fibromata and certain fatty tumours. They are encapsuled, very soft and succulent, and exude a peculiar mucous juice. They are most common in the subcutaneous or mucous tissue, but are found everywhere. They are seen as parotid growths, and often mixed with fibrous or cartilaginous elements. They are doubtless often mistaken for colloid cancer. In the typical *myxoma* the tumour is less firm but more elastic than the sarcoma; its nature is far less homogeneous, and presents less well-marked interlacing fasciculi of connective tissue, and from the meshes of this tissue will flow a variable stream of clear, translucent, viscid mucus. The fibres of the connective tissue are visible under the microscope, but in smaller bundles and more drawn out. Abundance of cells, also rounded, elongated, branching, and even anastomosing, together with nuclei, will be found to fill the cavities formed by the confused network of delicate fibres of which the tumour is composed. In the structure of the myxomata, fat often forms an important element; glandular elements may also be found, their presence being determined by the position of the growth and the propinquity of a gland. Bone or cartilaginous elements are at times mixed with the others (Fig. 41B).

Type of myxoma.

Myxoma. Characters.

Myxomata are not rare about the angle of the jaw, nose, breast, and abdomen. They are met with also in the extremities and in the eye, as well as in the delicate connective tissue of the nervous system, particularly of the brain and also of the nerves. When attacking the brain and nerves such growths are commonly found in the young; Virchow has named them *gliomata* (Fig. 41), the cells being of a small round or pointed form, embedded in granules and held together by delicate fibres. In some cases the fibre element approaches the firmer kind of fibro-cellular tumours (Fig. 41).

Glioma.

TREATMENT.—Excision is the only practice that can be followed;

although this operation need not be performed when the tumour is small and not progressing, especially when it occurs in aged people. Good success usually attends the practice. In the firmer varieties of myxomata, a return of the tumour is not to be expected, but in the softer where cell elements predominate, the risks of a return are great. Treatment of the fibro-cellular and myxomatous tumours.

c. Cancerous Tumours.

What is a cancerous tumour? Of what is it composed? and How can it be recognised? are questions which the student is constantly asking, and few are more difficult to answer with accuracy or precision. On cancerous tumours.

Pathologically, a cancerous tumour is composed of cells which more or less conform to an *epithelial* type, but the student must be prepared, in all, at any rate rapidly growing tumours, to find a great variety of cell forms, and it may with truth be said that the more the cell elements predominate in a growth, and the more they approach an epithelial type, the greater is the probability of its being malignant, and therefore cancerous; for the soft cancers, which are undoubtedly the most virulent, are made up almost entirely of cells and nuclei—only enough fibre tissue existing to bind and hold these cells together (Fig. 42).

It has been already shown how the sarcomatous tumour approaches the malignant in some of its features; and it must have been observed that these, which form the intermediate links between the innocent and malignant, structurally approach the latter, in having more of the cell elements in their composition. The recurrent tumours exist as proofs of this. Affinity of the recurrent and fibro-nucleated tumours.

But these points touch only the anatomy and not the symptoms of those growths; they do not assist the Surgeon to ascertain before its removal whether the tumour be a cancer or not.

What, then, are the external and general symptoms by which this point can be determined? And here it must be premised that in making a diagnosis, the history and progress of the disease is at least as important as the physical characters of the tumour. Symptoms.

If a tumour be found *infiltrating the tissues* in which it is placed, there can be little if any doubt as to its being a cancer, for no innocent growth infiltrates tissues—it only separates them. Infiltration as evidence.

A cancerous tumour, however, does not always infiltrate a part, although an infiltrating tumour is almost always a cancerous one; for it may appear as a distinct and isolated growth, being then, in surgical language, described as tuberous. What, therefore, are the symptoms by which a tuberous cancer may be known? What peculiarities has the tumour itself by which its nature may be recognised? Unfortunately, a negative answer must be given to this question, for although it may not be unfair to suspect the presence of a cancer when the tumour does not present any of the special appearances or symptoms which commonly characterise the innocent growths, it can only be a suspicion, as many innocent tumours are often deficient in the special symptoms, which, when present, readily attest their true nature. Cancer may not always infiltrate. Has no special appearances or symptoms.

A subcutaneous tumour, unconnected with the integument, with an irregular bossy outline, and of a firm, fibrous feel, will, in all proba-

bility, be of a simple nature, for these are not the characters of a malignant tumour; but another with a smooth uniform external surface may be either a simple or malignant growth. If, however, any adhesion or drawing in of the integument to the surface of the growth can be detected, or any immobility of the tumour upon the parts beneath, the suspicion of its being a cancer may be entertained (Plate IV, Figs. 1, 2, 3, 4); for the Surgeon should ever remember the tendency which the malignant tumour possesses to involve by infiltration the tissues in its neighbourhood, and that this tendency does not belong to the innocent growths.

Tendency to involve neighbouring tissues.

To produce enlargement of lymphatic glands.

I proceed further to direct attention to another symptom, which, if present, is most characteristic of cancer; and it is a secondary glandular, lymphatic enlargement. If this symptom appears, the probabilities of a tumour being cancerous become very strong, as innocent and non-malignant tumours are rarely, if ever, attended with enlarged lymphatic glands.

Presumptive evidence.

A distinct and isolated tumour, therefore, which does not possess any of the special characters of a simple growth; which is attended with some evidence of secondary affection or infiltration of the parts; and with which an enlargement of the lymphatic glands in its neighbourhood exists, may safely be regarded as cancerous. It is, however, only in the early stages of the development of a tumour that a difficulty in diagnosis is usually felt, because, as a rule, in the long-standing and well-developed growth the diagnosis is not difficult.

Soft or medullary cancer

Characters.

The soft and so-called medullary cancer is the form which is usually met with during young life. It generally makes its appearance suddenly, and often after the receipt of some blow or injury. It grows, too, very rapidly, presenting a surface which, as a rule, is smooth and uniform, or of a semi-solid and fluctuating feel, and with large full veins wandering across. It is recognised by its sudden appearance, rapid growth, and uniform surface, points very different from those which simple tumours present, innocent growths being generally slow in their development, and more marked in their outline. The cases of medullary or soft cancer run their course very rapidly, and destroy life within a very short period of their development.

Hard cancer. Characters.

Hard cancers are the affections of middle age and adult life. They grow more rapidly than the innocent growths, often not requiring more than a few months to establish their true nature; they seldom put on the external appearances of a simple tumour, and never exist long without assuming features which are more specially characteristic of cancer, the implication of neighbouring tissues and secondary glandular enlargements being the chief features.

Summary.

A *cancerous tumour* has therefore four characteristics:—

1. It infiltrates the tissue it attacks, and spreads by infiltrating neighbouring structures.

2. It spreads to the lymphatic glands of the neighbourhood through the absorbents.

3. It affects the body generally through the vascular system, thus giving rise to secondary deposits, that is to say, to the development of similar growths in the viscera, or remote parts, the lungs and liver being particularly prone to its attack.

4. It is liable to recur after removal.

Cancerous tumours have been variously described by authors. In

these pages they will be treated of as the *hard*, or scirrhus; the *soft*, or encephaloid; the epithelial; the colloid and *bone* cancers, or osteoid. Varieties of terms employed.

All have, however, the four special peculiarities that have been already described as characterising the disease.

Hard or scirrhous cancer is the most common. It is the hard or fibrous species denominated "carcinoma fibrosum." It is the usual form found in the female breast, and is seen in the testicle, tonsil, skin, bone, eye, rectum, or any tissue. When attacking a tissue either by infiltration (the most usual method) or deposition, it gradually encroaches upon the tissue; and when this is soft it causes its contraction as in the breast (Plate IV, Fig. 3). The disease spreads outward, and soon takes possession of neighbouring structures by infiltrating them. In this way it becomes gradually less movable, and at last fixed. No structures resist its influence; fat, skin, muscles, and bones becoming filled with cancerous elements as the disease progresses. It is said "to increase most on the side of the chief arterial supply, and in that towards which by lymphatics and veins its constituent fluids most easily filter." (Moore.) Scirrhous cancer. Mode of progress. No structures resist.

Thus the lymphatic glands become enlarged, and these in their turn may press upon nerves, causing pain, or upon veins, producing œdema. But cancers have not the power of living like innocent tumours, they are apt to degenerate and die; and thus, after a time, a cancerous tumour may soften down in its centre and burst, or die as a whole and slough out, or its surface may ulcerate. But, whatever happens, the disease spreads in the neighbouring parts; indeed, after the sloughing of a cancerous tumour, this spreading action in the bed from which it has been enucleated seems to be more rapid. Thus, the death of one part of a tumour is seen with the rapid increase of another part, and in this manner the disease goes on encroaching upon and infiltrating and destroying all tissues in their turn, causing death either by exhaustion, hæmorrhage, or some internal complication. Glands involved. Sloughing of the tumour. Ulceration. Termination.

In some instances of cancer, the integument over or about the tumour, before ulceration occurs, becomes infiltrated with small shot-like tubercles; such a tubercle in its early stage feels to the finger like a foreign body introduced into the cutis; and as this grows it appears as a distinct skin tubercle. No clinical symptom is more characteristic of cancer than the presence of these skin tubercles. When skin is infiltrated.

In other instances the whole integument becomes œdematous and brawny, in fact, infiltrated with cancerous elements, this state betokening the most rapid form of cancer. This brawny condition of integument commonly follows venous obstruction from glandular enlargement, but at times it takes place before any such complication. In rarer cases the cancer withers, "atrophic cancer," the disease slowly progressing to a point and then disappearing by a gradual process. Thus, cancerous tubercles will appear and disappear; cancerous nodules will form and fall off by the contraction of their own fibres. In this way cancer may become cured, or so stationary as not to interfere with life. I have had a case under observation in which the disease existed for twenty-three years, and seemed still local. I have recorded another in which the disease lasted twelve years, appearing and crumbling away at times during that period almost to a perfect cure. Cancers display a very variable degree of growing or existing power; and there does not seem to be any condition of the patient or of the tumour which either favours or disfavours these properties. Brawny condition of skin. Cancer may become atrophic. Variety in rapidity of growth.

Some have an apparent vigour of increase that is remarkable, whilst others show no such tendency. In many cases a tumour that has been quiescent for a long period will suddenly increase actively.

Cancerous ulceration.

The same thing may be said as regards the *cancerous ulcer*. In the atrophic form this may be merely a superficial loss of substance on the surface of the tumour which may be covered with a scab or present a glazed or a very slightly discharging surface. In other cases the ulcer will show an irregular surface with an elevated everted edge infiltrated with new tissue (Fig. 32).

When a cavity exists.

When a cavity exists, formed by the softening down of the centre of the tumour or the enucleation of dead tissue, the irregular outline of the cavity, the fœtid semipurulent sanious discharge, as well as the ragged and infiltrated edge of the wound are characteristic signs of its cancerous nature (Plate V, Fig. 1).

Cachexia.

In such cases a cachexia becomes visible, a pale, bloodless, haggard look of sorrow and suffering, brought on by pain, sleeplessness, and exhausting discharges.

Pain as a symptom.

Pain in the development of a cancer is a very variable symptom. In primary growths it is rarely severe, unless some nerve trunk be pressed upon, or the tumour is bound down by a tense fascia or is developed within a bone. Under all these circumstances the pain is constant, of an "aching or of a so-called rheumatic kind." In others, it is usually compared to an occasional dart of pain through the part.

As a sign of secondary deposits pain, however, is a valuable symptom; neuralgic pain following the course of a nerve being enough to excite fear of some deep-seated secondary growth. Than this no more valuable or reliable clinical symptom exists.

Section of scirrhous cancer.

The *section* of a scirrhous cancer is generally attended with a grating sensation, the parts cutting crisply; it presents a *concave surface*, and yields on scraping a milky juice (Plate VI, Fig. 1). The tumour has no defined margin, the diseased and healthy tissues, as it were, dipping into each other. The surface of the cut portion may be vascular or bloodless, and has a bluish-grey or streaked yellow aspect, according to the amount of cell or fibre elements entering into its formation, or to its progress towards degeneration; the yellow spots being indicative of degeneration. Occasionally cysts or rather cavities containing serum, blood, or broken-down tissues are found in the tumour, and, at others, creamy saponified masses of degenerated tissues.

The microscopical appearances of carcinomata are well shown in Fig. 42.

On medullary cancer.

Medullary cancer, like the scirrhous, is either *infiltrating* or *tuberous*, and possesses, in a marked degree, all the cancerous peculiarities. It is, doubtless, only a form of cancer and not distinct from the scirrhous varieties, because both often coexist, and the growths which are secondary to the hardest primary cancer are generally the soft variety. Medullary cancer is, however, the special form that appears as a congenital tumour, and which attacks children and young adults, and may be called "the cancer of young life." These growths form very rapidly and run their course far more quickly than the harder kind. They increase so fast that they push away the tissues with which they are surrounded more like the innocent tumours which separate them; their capsules prevent that general infiltration of the parts which is observed in the infiltrating form. It is found, although rarely, in the breast yet more

Rapid growth.

Situation.

frequently in the intercellular tissue, and about the periosteum and bones. It is the usual form attacking the eye, uterus, tonsil, testis, and ovary; the bones and cavities of the head and face appearing peculiarly liable to its inroads.

Characters.

These soft cancers usually appear as deep-seated swellings, and when not bound down by fascia or connected with bone are rarely painful; but when so situated a gnawing pain or ache is a frequent concomitant. As they progress and become more visible, they may present either a nodular lobulated or a smooth and uniform aspect; but in either case the integument covering in the growth will be traversed by many very large and dilated veins; while in some instances the growth has a bluish congested aspect, as if filled with venous blood (Plate IV, Fig. 4). These tumours are often so vascular as to pulsate, and thus simulate an aneurism. Such a symptom, however, is mostly observed in those connected with bone.

External appearance.

Vascularity.

Soft fluctuating feel.

To the touch the swelling feels soft and fluctuating, often giving the idea of fluid, and should the Surgeon, to satisfy himself upon this point, puncture the tumour with an exploring needle, blood will freely escape, and with it some creamy tissue, which, under the microscope, will be seen to be made up of cells and nuclei.

When bursting through fascia.

Fungus hæmatodes.

When these soft cancers have burst through their facial envelopes they grow more rapidly, and when they have made their way through the skin they, as it were, pulp out, and project much as a hernia cerebri does after compound fracture of the skull. The soft succulent granulations and blood-infiltrated tissues that project suggested to Mr. Hay, of Leeds, the term "fungus hæmatodes." When a soft cancer is filled with blood it is known as a "hæmatoid variety."

When they appear in the parotid region they usually if not always produce paralysis of the facial nerve; a clinical symptom I think I may say never found in the ordinary innocent parotid tumour, so that when present this symptom is of value. As a rule, however, this soft cancer surrounds nerves and vessels without materially pressing upon them; large vessels and nerves being often found passing completely through their substance.

Appearance on section.

The section of a soft differs from that of a hard cancer, as the "infiltrating" differs from the "tuberous" (compare Figs. 402 and 403, and Plate VI, Fig. 1); and differs also very materially in itself at different times. It may be firm or nearly fluid; white and creamy, or red and blood-stained. It may be soft from inflammatory action or degenerating from natural decay.

Lobulated.

Under all circumstances, however, it will be divided into lobules; fibrous septa or fibrous envelopes separating these lobules from one another, as the fibrous capsule of the parent growth separated it from the other tissues.

Material composing these cancers.

The material composing these cancers, says Paget, "is a peculiar, soft, close-textured substance, having very little toughness, easily crushed and spread out by compression with the fingers. It is very often truly brainlike, most like fœtal brain, or like adult brain partially decomposed or crushed. Many specimens are, however, much softer than brain, and many, though of nearly the consistence of brain, are unlike it, being grumous, pulpy, shreddy, or spongy, like a placenta with fine soft filaments. Very few have a distinct appearance of fibrous or other regular structure."

Yield juice on pressure.

These tumours when pressed or scraped yield abundant "cancer juice," and such juice is generally diffusible in water. No better rough test, says Paget, exists for the diagnosis of medullary cancer than this. The stroma of this cancer element is filamentous, and more or less condensed; it is also generally very vascular. The cell element always predominates, but the cells in no way differ in character from those found in the fibrous or scirrhous form. They are, however, less closely packed together, and seem to be suspended in the juices of the growth or enclosed within its delicate connective tissue (Fig. 42).

Epithelial cancer.

Epithelioma and epithelial cancer are terms given to a form of cutaneous cancer from its similarity in structure to the epithelial elements of the natural skin, these elements assuming in some cases, as in the cancers of the face, the smaller type of the epithelial elements, and in others, as in the lip, the larger.

In one case the disease may appear as a superficial thickening of the part affected, and in another as a nodular or warty growth. All these growths, however, have a tendency to break down, and this tendency varies in each case. In some it is very slight, whilst in others it is so rapid that the degenerative changes keep such even pace with the formative that the disease assumes from its very origin the appearance of an ulcer, when it is known as the "rodent ulcer" (Fig. 33). In the chain of malignancy epithelial cancers are linked to the recurrent tumours, for they have both a tendency to return in a part after their removal, and to affect the system through the lymphatics; while in exceptional instances they may be found in the internal organs.

Situation.

These tumours affect the skin or mucous membrane, and never originate in any other tissue. They possess this feature also in common with the more malignant cancers, in that they have a constant tendency to infiltrate the parts with which they come in contact, and do not, as innocent tumours, simply separate them. They are the common forms of cancer found in the lip, tongue, œsophagus, rectum, scrotum, penis, clitoris, os uteri, vulva, &c.; and may be described as the cancer of the skin, while in sweeps it is known as the "chimney-sweep's cancer." Epithelial cancer is essentially an infiltrating disease; it is not, as the sebaceous, fatty, fibro-cellular, or fibrous tumour, a distinct growth developed in the tissues and separating them, but it is from its very beginning an *infiltration*. It begins, as a rule, in a wart or tubercle, which grows; it may fungate, crack, fissure, or ulcerate, and when this latter stage has been arrived at, its true character will at once be observed by the careful examiner, as the integument forming its base a margin will be evidently infiltrat with the cancerous material, presen ing the well-known raised, indurate and everted edges (Fig. 32, also Frontispiece, Fig. 2). These appea

Fig. 32.



Cancer of stump, of two years' standing, from a man, æt. 58.

Sweeps' cancer.

ances form a marked contrast to the condition of integument which is met with where an innocent growth has ulcerated through or ruptured by over-distension its cutaneous covering (Plate V, fig. 4).

As a local disease, epithelioma may progress slowly for years and cause little pain, inconvenience, or injurious effects; and five, six, eight, or even fifteen years have elapsed in some of the cases that have been under my notice before advice was sought; it may moreover continue for many years before it affects a patient in other ways than as a local disease. On the other hand, when it once begins to spread, it may do so rapidly; and after removal it may return at once, not only in the part, but in the lymphatics of the district, and even in the internal organs. When it spreads locally, it may, as a cancer, infiltrate and invade every tissue which it reaches. I have seen it more than once originate in skin, and end in a total destruction of a bone (*vide* 'Guy's Hosp. Rep.,' 1875). May spread rapidly

Epithelial cancer is made up of cells, which differ but little from those of ordinary epithelium, though they are grouped very differently; they infiltrate the tissues in which they are placed or are clustered together in masses, these masses being described as "nests" (Fig. 42). Epithelial cancer: its characters.

The surface of an epithelial cancer may be dry and warty, or ulcerating; when ulcerating, it will be, like all cancerous sores, irregular, and will discharge a thin or a creamy fluid. The edge will always be thick and elevated, like a wall of new tissue built up between the healthy and diseased structures (Plate I, fig. 2; Plate V, fig. 1, also fig. 32). When the disease spreads it will invade and infiltrate every tissue, forming deep excavated sores. It may involve the lymphatic glands like any other cancer, and these glands may soften down, and give rise to a cancerous abscess or an open sore. It usually destroys life from local causes, and not from secondary infiltration of the viscera, such a consequence being quite exceptional. May involve glands.

These cancers should always be removed, and the sooner this is accomplished the better the prospects of a cure or of a long reprieve, for if any cancer has a local origin the epithelial has, and if it be removed before any glandular enlargement has taken place the prospects of a good result are great. Sibley ('Med.-Chir. Trans.,' vol. xliii) made out from the Middlesex Hospital records, that epithelial cancers, on the average, destroyed life in fifty-three months, while scirrhous lasted but thirty-two. When removed by the knife, care should be taken to cut well free of the disease, for it is not unusual in this, as in all cancers, to find the tissues around the tumour sparsely infiltrated with cancerous elements, which, if left, would cause a return of the tumour. The same advice is applicable when caustics are employed. Treatment of epithelial cancer. Removal by knife.

In many examples of this form of the disease the removal by the galvanic cautery is by far the best method of treatment we possess, either as a cautery applied to the surface, or as a wire écraseur applied around the base. Removal by cautery.

Rodent ulcers are forms of epithelial cancers. Dr. J. C. Warren, of Boston, U.S., in an able essay upon this disease, asserts that the cells of the rodent ulcer differ from those found in the epithelial by being smaller. They are local cancerous affections, and expend their force in destroying every tissue attacked, but they do not spread by means of the lymphatics or by secondary growths. They usually begin on some part of the face, head, or other locality as a dry wart, which, after it On rodent ulcers. Characters.

has shed many skins, begins to ulcerate. The ulcer then spreads slowly and regularly, with a border of new tissue raised as a wall, to separate it from the healthy parts; outside the border the parts are soft and natural, inside they are generally smooth, as an indolent sore, devoid of granulations, and glazed (Fig. 33). There is little discharge from these sores when superficial, but when they are extensive, and have dipped down deeply into other tissues, this is not the case; and when they inflame, they discharge a fetid ichorous pus. They seem to attack healthy as well as feeble subjects, and have little effect upon the general health until they touch vital parts. They appear after middle age, and are of extremely slow growth; they are to be treated locally, by their destruction — cautery, escharotics, or scalpel being used, as seems most applicable. In local sores the knife, when it can be used, is probably the best instrument; but in others the galvanic cautery is unrivalled. In lieu of this the benzoline cautery may be used, and next to this, escharotics; "the caustic burns through the entire depth of the solid disease, and upon the casting of the subsequent slough, cicatrisation is rapidly completed."—*Moore*. Chloride of zinc, potassa fusa, Vienna paste, or acid nitrate mercury may be applied; the zinc rubbed down in a warm mortar with equal parts of fresh plaster of Paris is probably the best, because it destroys and dries the tissues.

Fig. 33.



Rodent cancer of the face, from an original drawing of Sir Charles Bell's, contained in the museum of the Middlesex Hospital, and recognised by Messrs. Shaw and Campbell de Morgan. It was introduced to my notice by my friend, Mr. Henry Morris, of the Middlesex Hospital, and kindly placed at my disposal by the Museum Committee of that Institution.

Treatment of rodent ulcers.

Colloid cancer.

Colloid cancer is hardly recognised as a special disease, for the term "colloid" is applied to tumours made up of intercellular spaces of variable sizes, filled with a clear glairy fluid like glue, which contains abundance of granules and large nucleated cells (Fig. 42). The clinical history of some of these growths is that of an innocent tumour, whilst in others it is that of a cancerous nature. Colloid tumours are found in the breast, parotid region, ovary, rectum, and intestinal canal, it being known in this last region as the alveolar or gelatiniform cancer. Their true nature is not yet fully understood.

In the case Fig. 34 the patient was 65 years of age, and the disease had been growing for two years. The tumour occupied the outer por-

n of the gland, and had burst the skin covering it in. The colloid Colloid followed by scirrhosis.
with projected through the opening, the margins of which, however, re not infiltrated with disease. There were no enlarged axillary nds. This patient was eight years subsequently readmitted into y's under my care, in May, 1881, when she was seventy-three, with true carcinomatous affection of the nipple of the opposite breast, ich had been recognised for six months. The nipple was retracted

Fig 34.



Case of colloid tumour of the breast, discharging externally, in a woman, æt. 65, with section of the same.

nd involved in an indurated mass of disease about the size of a walnut. The lymphatic glands were healthy, as was the scar of the old operation. *Villous growths may be cancerous as well as* benign. When made Villous growths.

up of cell-elements their cancerous nature is to be suspected, but the fact is only to be discerned by the clinical career. The nature of villous and colloid disease has been very ably discussed by Mr. Sibley, in the 'Med.-Chir. Trans.,' vol. xxxix, and 'Path. Trans.,' vols. vii, viii, and ix.

The Causes of Cancer.

On causes of cancer.

These are most obscure, but the most constant cause is without doubt persistent local irritation. *Local injury* also appears to have a very

Local injury.

marked influence in determining the seat of a cancer, many cases supporting this view have fallen under my observation, and one of such occurred to me recently in the case of a boy, æt. 18, who, after an injury to his right spermatic cord, in a few weeks became the subject of a pelvic tumour, which rapidly grew, and eventually destroyed life by obstructing the rectum as well as the ureters. After death the tumour was found to have been cancerous, having originated apparently in the right or injured cord, spreading downwards along the vas deferens to the base of the bladder, and subsequently ascending from the pelvis, above the level of the umbilicus.

Hereditary influence.

Hereditary influence has always been considered as a very decided cause, still in how small a proportion of cases can any such be found? Sir J. Paget traced it in one out of every three; Mr. Sibley in one out of every nine; and in 222 consecutive cases of my own, it was traceable only in one out of every ten instances. In many other affections, even the most innocent, as large a proportion might be found. In fatty tumours and in deformities, all Surgeons recognise the frequency of an hereditary history. Indeed, looking at cancer as one of many diseases, there is no reason for regarding it as more hereditary than any other, and I am inclined to agree with Mr. De Morgan when he said "that all that could be said with regard to the constitutional nature of cancer applied equally to the constitutional nature of any, the smallest, growth that can be found in the body."

The death rate of cancer, according to the Registrar General's Report, is 1 in 2083 cases, but and from the same authority cancer is become more common. Mr. W. H. Cripps shows, in a paper in the 'St. Barth. Hosp. Rep.,' 1878, that the death-rate from cancer in the community in subjects over 20 is about 1 in every 29·1 cases.

Striking examples of the hereditary nature of cancer are met with in practice, but they are not more striking, if so much so, as the hereditariness of growths of a simple kind. Sir J. Paget has pointed out, however, that when a local disease or deformity is inherited, it passes from progenitor to offspring in the same tissue, if not in exactly the same place, whereas, when a cancer is hereditary, it may break out anywhere. "The cancer of the breast in the parent is marked as cancer of the lip in the offspring. The cancer of the cheek in the parent becomes cancer of the bone in the child. There is in these cases absolutely no relation at all of place or texture."

A disease of adult life.

Cancer is a disease of adult life, although it may attack a fœtus in utero, or an infant soon after birth ('Guy's Hosp. Rep.,' 1875). In a general way it is most prone to attack an organ that has passed through the active period of its existence and is degenerating, as in the breast or uterus. Sir J. Paget describes it as being "essentially a disease of degeneracy," and asserts "that it increases in frequency

n proportion to the number of persons living as age goes on." When t does affect an organ in the full vigour of its functional activity, it partakes of that activity and runs its course with marvellous rapidity.

Cancer appears to be in its origin a local disease and to become Origi general either by the influence of the juices of the primary tumour exercising an impregnative, spermatic, influence (Simon) upon other parts, or by dissemination of its elements. This dissemination at first may radiate from its local source, and at a later period may become general through the fluids of the body; the secondary growths will partake largely of the characters of the primary, thus the osteoid cancer will propagate osteoid, and the melanotic melanosis, each cancerous growth, like a parasite, growing at the expense of the tissue in which it lies. Moore, in his work on the 'Antecedents of Cancer,' and De Morgan more recently, have, I believe, established this fact. From a clinical point of view this is, without doubt, of very practical significance, for Surgeons now admit, that the earlier a cancerous tumour is removed the better are the prospects of a cure, or, at least, of a long immunity from the disease.

Treatment of Cancer.

The *general treatment* of cancer resolves itself into the improvement Treatment of the general nutrition of the body by hygienic means, good nutri- cancer. tious diet, and tonic medicines. No medicine has any special influence on the disease.

The *local treatment* may be summed up in the word "removal," for Local all cancers should, if practicable, be taken away as soon as their measures. true nature has been established. In the early stage of a cancerous tumour, before the diagnosis has been made out, it should be protected from external injury, and from all irritating causes. No rough manipulation should be allowed, nor any movement of the muscles that surround or influence it. Warm or hot applications should Avoid hot be avoided, since they appear to encourage its growth. The most acute applications cancer of the breast I ever saw was one that originated as a chronic infiltration, and was made active by the application of hot fig poultices for a week. The gland itself and skin over it to the limit of the application became infiltrated to an extreme degree with cancer, which rapidly broke down, and destroyed life.

Moore used to think highly of the local application of the iodide of Iodide of lead and and opium ointment applied on lint to the tumour, and he believed opium. had some influence in diminishing and retarding its growth. Some faith in iodine as a local application; but I must admit that I never been able to discover that any of these or other applications the slightest influence in checking the progress of a cancer, and consequently discarded them. When pain is present the bella- Belladonna donna-extract rubbed down with glycerine into a fluid the consistence of cream, or of the extract of opium similarly diluted, seems to be a valuable application. An opium or belladonna plaster spread on leather gives comfort and protects the part. The best protective application, however, is cotton wool.

When the diagnosis is established the tumour should be removed, Excision. the best method, doubtless, is that of excision, delay being only justifiable when the general condition of the patient forbids the attempt. Delay is only to increase the risk of a local dissemination of the can-

cerous elements, and thus diminish the prospects of a successful result, to give time for the lymphatic glands to become enlarged, when removal of the primary growth becomes of less value; and to increase the chance of some internal or remote organs becoming involved, when operative interference is futile.

Free removal. In removing a cancerous tumour the Surgeon should not be too sparing of surrounding tissue; but when it is encapsuled there is no necessity for doing more than enucleating the mass. When it infiltrates an organ the only correct treatment is its removal, and in removing it care should be taken to cut away all skin that is in any way adherent to its surface, with as much of the surrounding fat as circumstances will allow.

Avoid leaving tubercles behind. When the tumour has been removed all surrounding parts should be carefully examined, because it is not uncommon to find small cancerous tubercles in the connective tissue, fascia, or muscular sheaths, which if passed by unheeded would soon increase and give rise to a recurrent growth. It is from these points, indeed, that such recurrent growths probably often arise, and these, by care and observation, the Surgeon may often prevent. De Morgan, after excision of a cancerous tumour, washed the wound with a solution of chloride of zinc, twenty grains to an ounce, in order to destroy the cancer germs. The surgeon, too, had better remove all skin, and allow the wound to granulate up, than save integument which is of doubtful integrity for the sake of making an apparently more complete operation.

Glands to be removed. When lymphatic glands are enlarged, they should be removed at the time of operation, and they should be enucleated by the fingers or handle of the scalpel rather than be excised—their capsules ought to be divided and the glands turned out.

Cancerous tumours of the tongue, penis, clitoris, labium, neck of the uterus, &c., may be removed by the wire or chain écraseur, either with or without the cautery; but this part of the subject will receive attention in other pages.

Removed by caustics. When a cancerous tumour cannot be excised or the cutting operation is rejected, it may be removed by caustics; but such a method is more painful, slower, and not so successful as excision. When employed as a substitute for it, it is, like all substitutes, only second best; yet it is, however, often applicable where excision is not. The French surgeons do this by inserting around and into the tumour thin conical flat wedges of chloride of zinc made into a hard mass with flour or plaster of Paris, holes being made into the tissue by the scalpel for the introduction of these flèches. Maissonneuve is the chief practitioner of this school.

Caustic arrows. These "caustic arrows" of M. Maissonneuve are composed of wedge-shaped pieces cut from a thin cake of paste made by mixing one part of the chloride of zinc and three parts of flour with as much water as may be found necessary. These pieces or arrows are dried, and may be kept in a bottle for a long time without injury.

Strong acids and caustic paste. In England this plan finds little favour. The following method is more general:—In a tumour that is not ulcerated let the skin be destroyed by the application of some strong sulphuric or nitric acid, and in this slough let one or more incisions be made, and into these incisions let a paste of chloride of zinc and flour mixed with the extracts of the Sanguinaria Canadensis, and stramonium, be introduced; fresh incisions being made through the thickness of the slough thus formed

every other day, and fresh paste inserted. By this means the whole tumour may be destroyed or enucleated. The paste is a modification of that introduced into London by Dr. Fell, of the United States, and is, without doubt, the best working caustic paste we possess. The following is the mode of its preparation:—Boil down to a liquid extract some decoction of the Sanguinaria Canadensis, and, with an ounce of the extract dissolve a similar quantity of the chloride of zinc. Mix this with two ounces of the extract of stramonium, and the soft paste is ready for use. Fell's paste.

Canquoin's paste is composed of chloride of zinc and flour in equal parts, a few drops of water being necessary to make it into a paste. A second form is probably better:—Chloride of zinc one part, muriate of antimony one part, flour one part and a half, water a few drops. This paste is of the consistence of soft wax. At the Middlesex Hospital they use a paste made by mixing chloride of zinc and boiled starch with laudanum, till it reaches the consistence of honey. Canquoin's paste.

When the tumour is ulcerating or open, the paste may be applied directly to the part, and fastened on by cotton wool and strapping; the thickness of half an inch applied for twelve hours usually produces a slough an inch deep.

Some prefer a solution of chloride of zinc alone inserted on cotton wool. M. Rivallié uses nitric acid applied on lint or asbestos; Velpeau, sulphuric acid on saffron. By some the Vienna paste is preferred. Arsenic as a caustic has had its day, and is dangerous and less effective than zinc. Other caustic applications.

For cutaneous epithelial cancer the caustic treatment is the best. The chloride of zinc made into a paste with flour, or with sanguinaria, may be used, if preferred. The potassa fusa is likewise a useful form. When the galvanic, or thermo-cautery can be obtained epithelial skin cancer may be readily destroyed. I have burnt down many such affecting the nose, cheek, eyelid, scalp, hand, arm, lip, and other parts. By it large surface of diseased tissue may be completely carbonised and a healthy surface produced after the removal of the eschar. The operation should be performed with the aid of chloroform, and the whole thickness and edges of the diseased tissue destroyed. The after-pain is very slight, the cautery destroying all nerve sensibility. It is by far the best mode we possess of dealing with skin cancer, is more rapid in its action and certain in its result, besides being far less painful. When the disease extends it may be removed with the scalpel and the base of the sore cauterised. No more efficient mode of removing a skin cancer is within our reach. Thermo-cautery in epithelial cancer.

The treatment of tumours by injection of fluids into their substance, as originally suggested by Sir J. Simpson, and more recently practised by Dr. Broadbent, has in it the elements of a successful plan, but has not yet been brought to any available state of perfection. Fatty tumours may be destroyed by the introduction into their substance of a few drops of deliquescent chloride of zinc, but cancerous tumours do not appear amenable to a like remedy. Dr. Broadbent believes that he has succeeded by injecting a liquid composed of one part of acetic acid and three of water; while Messrs. Moore and De Morgan assert that they have each succeeded by these means in obtaining gradual diminution of cancerous growths. I tried the plan in twenty cases, when it was first introduced, but never found any good result ensue. It was often very painful, and many patients refused to have it repeated, On treatment of tumours by injection.

although they asked for the excision of the growth. More recently the injection of twenty drops of a solution of bromine dissolved in spirit, ɱv to a ʒj, has had its advocates.

Treatment by pressure.

The treatment by pressure is of no practical utility.

By way of summary, it may be stated (I) that cancerous tumours should be excised when practicable, and the sooner the operation is performed, after the diagnosis is clear, the better. That with the primary growth all lymphatic glands that are involved should be removed likewise.

Treatment of open cancer.

(II) Open cancerous tumours, as a rule, should be treated by caustics, the best being those which contain chloride of zinc.

Of skin cancers.

(III) For skin cancers caustics are, as a rule, the most available, although excision in some instances, as in the lip, is to be preferred. The galvanic or thermo-cautery, however, should be employed when possible, it being the most rapid and efficient destructive agent we possess.

D. Granulation Tumours

Include all composed of granulation tissue and have their origin in inflammation, whether of a specific or simple kind; the fungating and follicular tumour and the pedunculated umbilical growths are its best examples, but it occurs in many other shapes.

Follicular tumours. Characters.

Fungating and Follicular Tumours.—In neglected examples of sebaceous cyst the contents of the tumour may soften down, and, suppurating, escape externally by ulceration. From the inner surface of the evacuated cyst a new growth may spring up, which, when forming an irregular, fungating, bleeding surface may at times put on an appearance which has been mistaken for cancer. On examining the edges of the wound, however, this mistake can scarcely be long entertained, as it will be at once observed that the edges of the wound are healthy, and not infiltrated with new matter, as would be the case in a cancer (Fig. 35). This fungating growth is really composed of exuberant granulations from the cyst itself; Abernethy recognised this when he said, "I have also seen after the bursting of an encysted tumour the surrounding parts indurate and throw out a fungus, forming a disease appearing like a cancer, and which could not be cured." And "it is no uncommon circumstance to meet with wens that have burst spontaneously and have thrown out a fungus, which, like a fungous body, prevents the surrounding integument from healing." The best account of the affection is by Mr. Cock ('Guy's Rep.,' 1852).

FIG. 35.



Fungating follicular tumour.

Abernethy's account.

TREATMENT.—There is but one form of treatment which is applicable to these tumours, and that is their excision, care being observed to cut away the whole of the diseased tissue.

Granulation tumours probably include the keloid.

E. Cysts.

These are developed in many ways:

1. Some are possibly new growths or largely developed cells, having an independent life and being capable of secreting their own contents, or producing solid growths;—auto-genous cysts, as Sir J. Paget calls them. Cystic tumours, mode of development.

2. Some are formed in an accidental way by the simple effusion of fluid into the spaces of connective or other tissues, the walls of these *false cysts* gradually consolidating, as is commonly seen in bursæ and in ordinary tumours.

3. Others, again, are produced mechanically by the dilatation of occluded ducts or natural gland-orifices, the cyst enlarging by the secretion of the ducts or gland contents. Of these the mucous cysts of the mouth and vagina, the sebaceous cysts of the skin, and the milk cysts of the breast, are the best examples. Virchow calls these cysts by retention.

In many cases, however, it is impossible to ascertain how the cysts are formed. Some are parasitic.

Serous cysts are most commonly found connected with one of the vascular glands of the body, as the kidney, ovary, thyroid, or breast, but they are not rare in the connective tissue, and are found even in bones. When seen in the neck they are described as "*hydroceles of the neck.*" Some of these are congenital, but the majority occur later in life. They appear as single or multilocular cysts, made up of thin membranous walls, lined with pavement epithelium. Like a serous membrane they contain a limpid, watery, or tenacious highly albuminous fluid, more or less stained with blood, occasionally holding cholesterine in suspension. These cysts are found in the neck, anywhere between the lower jaw and clavicle, beneath which they at times pass (Fig. 36); they are usually deeply seated, and occasionally superficial; they give annoyance only from their size, and are painless; when inflamed, they may suppurate. They are recognisable by their globular cystic form, soft fluctuating feel, and painless increase. Serous cysts: situation. Characters. Diagnosis.

Fig. 36.



Serous cyst of the neck. (Birkett's case).

These cysts are not to be confounded with those of the *thyroid gland*, which are far more common, and at times attain a large size, growing as quietly and painlessly as do the cervical. Usually, however, they have thicker walls, are more tense, and are commonly multiple; moreover, they move up and down with the gland on deglutition. Their contents are more viscid and frequently mixed with blood in variable proportions; *indeed, some of these thyoid cysts* are *blood cysts*, which Not to be confounded with thyroid cysts.

when tapped would go on bleeding if allowed, even to the death of the patient. I have recorded such a case ('Guy's Reports,' 1864). It is probable, as Sir J. Paget has suggested, that many of the cervical cysts are thyroid in their origin, springing from some outlying portion of the gland.

Cysts are also found over the thyroid cartilage, but these mostly contain grumous blood, and rarely grow larger than half a walnut. In a case under my own observation, a cyst completely covered the thyroid cartilage, and was lost on either side in the deep tissues of the neck. It existed in an adult man as a soft fluctuating swelling, and had been growing for some years as a painless formation.

Cysts which are possibly bursal are likewise found in connection with the hyoid bone.

Treatment of cystic tumours.

TREATMENT.—Cervical cysts had better be left alone, unless from their size they require surgical treatment, because there is always danger in dealing with any deeply-seated cyst in this region from the liability of subsequent diffused inflammation of the cellular tissues of the neck. I lost a patient, some years ago, from this cause, after simply tapping the cyst.

Palliative.

When surgical treatment is called for, *palliative* means had better be primarily adopted. This treatment consists in merely drawing off the contents of the cyst by means of a trocar and canula, or the "aspirator." Should the fluid re-collect rapidly the operation may be repeated. In performing this operation the Surgeon to guard against puncturing any of the superficial veins or deep vessels, should recall their position before puncturing.

Tapping.

Should these measures fail, even after several repetitions, the best practice is to introduce into the cavity of the cyst a drainage tube. When the tapping has induced some suppurative action the opening may be enlarged and the tube inserted, but when the cyst is large it is well to pass the tube completely through it. This may readily be done by means of a long trocar and canula, such as that employed for puncturing the bladder per rectum, the pilot trocar being introduced into the cyst after it has been opened and made to traverse the cyst to its most dependent point, possibly beneath the sterno-mastoid muscle. The pilot trocar should then be removed, the drainage tube passed through the canula, and the canula taken away, the two ends of the tubing being fastened together to prevent its slipping out. I have treated many cases of deep cervical cysts in this manner with success.

Points to be attended to in tapping.

The great point to attend to is the free escape of pus and the cyst contents; if air gets in let the opening be free enough for it to pass out. Should fœtor appear the cyst should be washed out daily with iodine or chloride of zinc lotion, Condy's fluid, or some other disinfectant. As the cyst contracts the tube may be removed, but so long as any cavity remains it should be left.

Seton.

The passage of a seton through the cyst is another method which may be adopted, and this is probably more suitable for small than for large cysts.

Injection.

Injecting the cyst with iodine is a third plan which has proved successful, though it is as dangerous as any other, and not more successful.

Extirpation.

Extirpation of any large cervical cyst is a mode of treatment which should not be entertained, since it is fraught with danger and difficulties.

Treatment of thyroid cysts.

Thyroid cysts and their treatment will receive attention in another chapter.

The student should remember that nævi, when they degenerate, commonly show cysts in their structure (Fig. 141, and Plate I, Fig. 4, Plate II, or Fig. 195B); these are, however, usually clustered together in a cutaneous or subcutaneous group. When they appear in the neck they might be mistaken for one or other of the cysts already alluded to. This mistake will be prevented by remembering the fact that they do occur, and by the history of the case. Nævi may degenerate into cysts.

Congenital cystic hygroma or **tumour** is a peculiar affection, the nature of which is not clear. It may appear in the neck, its most common seat, or elsewhere, as a cystic swelling, or as a more or less compact solid growth—the cystic element varying in each case. It is always deeply placed beneath the fascia, and dips down beneath muscles, tendons, and vessels. The skin over the tumour is as a rule healthy and moveable; but in some cases, from the lobulated nature of the tumour, the skin is dimpled as in a lipoma. From its appearance and position it may simulate many other affections, such as nævus or spina bifida, but pressure upon it has no influence in lessening its size. Hygroma.

The disease has a tendency to disappear naturally, though at times it may grow rapidly. In some cases it inflames and then shrinks.

When treatment is absolutely called for, that by setons, as suggested by Mr. Thomas Smith, 'St. Barth. Hosp. Rep., 1866,' is the best. The knife should be employed in exceptional cases alone. The value of injection of iodine or Morton's iodo-glycerine solution, has yet to be tested.

Mucous cysts are found wherever mucous glands exist, and are caused by some obstruction to the escape of the gland contents. They contain highly tenacious mucus-like liquid albumen. They appear on the mucous membrane of the lips as *labial cysts*, and are small, tense, globular, painless swellings. They are found within the cheeks, upon the tongue and gum, particularly of the upper jaw and antrum, and very commonly beneath the tongue, as *sublingual mucous cysts*, when they have been described as cases of "*ranula*." Such cysts, however, are now known to be due to obstruction of the ducts of Rivini's mucous glands, and are not necessarily connected with the salivary organs (Fig. 191). These cysts may develop about the larynx, and cause obstruction, and they have been found in the œsophagus. As labial and *vaginal mucous cysts* they appear as tense, globular tumours beneath the mucous membrane of the parts. I have seen them as large as an orange. These cysts generally contain thick, ropy, mucoid fluid of a colourless or slightly yellow tint. Occasionally the fluid is mixed with blood in different proportions. I have seen them contain black, milky, or coffee-ground fluid. Sometimes they inflame and suppurate, and run on into abscesses. On mucous cysts. Ranula. Vaginal and labial cysts.

TREATMENT.—Small labial cysts may often, on dividing the mucous membrane over them, be turned out as a whole, but the sublingual and larger vaginal cysts, as a rule, cannot be thus treated. A free opening into them, or the removal of their external wall, and the introduction into the cavity of a plug of lint soaked in iodine to excite suppuration, may at times suffice to bring about a cure, but not always. In the so-called ranula it may be tried before other practice is attempted. In the sublingual, labial, and vaginal cysts, I have for some years been in the habit of seizing the upper surface of the cyst with a pair of forceps or tenaculum, *and cutting it off* with scissors, thus freely *exposing the deeper wall. In the sublingual this* practice is, as a rule, Treatment of mucous cysts.

successful without further treatment, but in the labial and vaginal cysts I have in addition generally destroyed them by the application of some caustic, such as nitrate of silver or carbolic acid, to the exposed surface, after which the wound will granulate healthily. When these cysts can be excised the operation may be performed.

The mucous cysts of the antrum and upper jaw will be described amongst the tumours of the jaw.

Cutaneous sebaceous cysts.

Cutaneous sebaceous cysts, as they come under the notice of the Surgeon, appear as "*congenital*" and "*acquired*" tumours. They are analogous to the mucous cysts, the glands of the tissue being in both

Causes.

instances at fault. Some are doubtless caused, as first described by Sir A. Cooper, by the obstruction to the orifice of the sebaceous glands of the skin, for this occluded orifice may often be seen as a small depressed black umbilicated spot upon the tumour; the contents of the cyst may often be squeezed through this orifice, or into it a probe may be passed. In a larger proportion of cases, on making an attempt to raise the skin from the tumour, a dimple or evidence of connection between the two will be visible, thereby revealing its nature. But in other cases no such obstructed duct or even cutaneous depression can be observed; and although the tumour may be developed within the integument, it is probably a new formation, an adenoid or glandular skin tumour.

Congenital sebaceous tumours

The **congenital** sebaceous tumours differ from those usually met with in the adult, or the acquired form, in that they are more deeply placed and mostly lying beneath the fascia of the part, occasionally beneath the muscles; they are rarely cutaneous. They are more common about the orbit and brow than any other part, the external angle of the eye being their favourite seat. They appear as small, hard, semiglobular masses deeply placed and are often indeed, upon the bone. Cases, too, are on record, in which, by their presence, they have produced perforation by absorption of the bone. In the ear this result is not rare. These cysts are thin-walled, and often contain liquid secretion; sometimes of a pearly whiteness, and not rarely mixed with hair. I turned a complete ball of hair out of such a cyst on one occasion, though usually the hairs are fine like eyelashes, and are mixed with the sebaceous matter. The contents of these congenital cysts are rarely offensive.

The acquired sebaceous cyst.

The **acquired** sebaceous cysts may be found on any part of the body that is covered with skin. They are more common on the head and face than elsewhere, two thirds of all cases occurring in these regions: when on the scalp they are known as "*wens*" (Fig. 37). They are always surrounded by a cyst-wall, composed of fibrous tissue more or less dense, and which can always be seen after these tumours have

Wens.

been enucleated from their beds. In "wens," however, there is a marked peculiarity which demands some notice. "The chief peculiarity consists in a thick dense horny capsule, which is closely in contact with the fibrous envelope of the original gland. This horny capsule was formerly regarded as the cyst-wall altered by pressure, until Sir Prescott Hewett demonstrated its true relations and anatomical structure in his lecture at the College of Surgeons. It is now clearly proved that when one of these sebaceous tumours is squeezed out after the division of the skin, the fibrous cyst remains behind.

Construction of horny capsule.

This cyst can be afterwards excised, and its structure is identical with that of all the others. But the construction of the horny capsule requires explanation. If carefully examined it is found to consist of

epithelium layer upon layer, mixed up with sebaceous matter. Sometimes a solid mass of epithelium is formed, in other instances a cavity exists in the centre, filled with soft sebaceous secretion. This capsule then seems to be a production of the epithelium of the sebaceous gland, which, being subjected to the pressure of the unyielding textures in which the tumour is developed, becomes converted by slow degrees into a tissue closely resembling horn or fibro-cartilage" (Birkett, 'Guy's Rep.,' 1859).

These sebaceous tumours are more frequent in women than in men, and are, beyond doubt, hereditary; Sir J. Paget says "they are certainly more commonly hereditary than are any forms of cancer."

The dermoid cysts of the ovary are only of pathological interest, as are the dentigerous cysts of these parts. The dentigerous cyst of the jaw will be treated of in the chapter on diseases of the jaws.

FIG. 37.



Sebaceous tumours in scalp, and horn.

Oil cysts. Oil cysts are met with, though rarely, and they are probably always dermoid. I removed one from the parotid region of a girl, æt. 18, which was congenital. It contained liquid oil ('Path. Soc. Trans.,' vol. 33, 1882).

Treatment of follicular tumours. TREATMENT.—The only correct treatment of these sebaceous or skin cysts, whether whole, broken, or fungating, consists in their removal. In removing "wens" or *acquired* cysts, however, it is not necessary to be too careful in dissecting them out entire, and the most effective method is to slit open the tumour with a bistoury and then turn it out with the forceps or handle of the knife. In the removal of sebaceous cysts from other parts of the body the capsule of the cyst should be taken away, while in the fungating tumour the whole mass ought to be excised. *In the treatment of the congenital* tumour it is always *better to try and dissect out the cyst entirely;* but nothing is more

Congenital sebaceous cysts.

unsatisfactory than operating in such cases, for the cyst is always deep, its capsule thin and adherent, and any attempt to dissect it out, as a whole, is too often foiled by the bursting or puncturing of the capsule and the escape of its contents. When this occurs the Surgeon must take away as much of the capsule as he can and then close the wound, a good result following, as a rule, though at times a recurrence of the growth will ensue.

The fear of erysipelas after these operations is really almost groundless. It may arise, but out of more than one hundred cases consecutively observed, I have not seen one example. Pyæmia may follow this as it may any other minor operation, but not more frequently. When patients are cachectic, such an operation of expediency as that for the removal of a "wen" had better be postponed, for under low conditions of health blood poisoning is likely to follow. Should, however, its removal be urged, this may be done by the injection into the cyst of some caustic, such as a few drops of deliquescent chloride of zinc, of carbolic acid, or the external application of nitric acid, or potassa fusa, to produce a slough through the skin, when the contents of the cyst may be turned or drawn out.

When operation to be postponed.

Caustics.

THE MICROSCOPICAL ANATOMY OF TUMOURS.

By Dr. Moxon.

Every texture of the body in its earliest embryonic stage of development is altogether composed of cells, which have in their primitive condition no noticeable substance between them. As the texture progresses in its development the uniformly cellular composition of its primitive substance undergoes modification. Some of the cells become separated by intercellular substances of various kinds; others change to capillaries, lymphatics, and nerves. Yet others retain their cellular form, and remain in close contact with each other. The general result is, that when the several textures of the fully developed frame are studied in the course of minute anatomy, each texture is found to show in its ultimate construction some remains of its cellular origin, more or less evidently recognisable. In some tissues, such as the epithelial coverings and linings and the cellular parts of the lymphatic glands, of the thyroid, &c., the cells remain always distinct from each other, although in close mutual contact. In the several kinds of tissues of the connective class, including cartilage, tendon, bone &c., a large proportion of intercellular matter separates the cells. This intercellular matter taking the form of hyaline or elastic substance, as in cartilage; of fibres, as in connective-tissue and tendon; or of calcified substance, as in bone. The cells remain separate in cartilage; but in the other tissues of this class they send out processes, which unite to form a network throughout the calcified or fibrous intercellular substance which constitutes the greater part of the tissue.

In the proper substance of muscle and nerve, tissues endowed with special dynamic powers, the original cells generally blend more completely, composing tubes or fibres. These tissues show very little disposition to form tumours, or even to share in their formation. There is one exception to this indifference in the case of nonstriated muscle: the fibres of this kind of muscle retain to a large extent their embryonic

Tumours of nonstriated muscle.

characters, and never quite lose their primitive cellular composition; the original cells are comparatively little altered, and remain still distinct. And with these embryonic characters the fibres of nonstriated muscle show a capability of extensive new growth; rapid production of this tissue occurs during adult life in the pregnant uterus. And tumours of nonstriated muscle fibre are not uncommon in the uterus and elsewhere. This texture is indeed of great interest pathologically, as showing the association of a power of new growth in a highly endowed tissue, with a persistence of embryonic form in its elementary fibres. It is, perhaps, the most striking example of what is generally true in both normal and pathological histology, namely, that with embryonic form, in texture elements, goes always power of increase and multiplication.

Blood-vessels in new growths.

The behaviour of the blood-vessels in the formation of new growths is an interesting field of study, in which useful observations may yet be made. It will be found that the blood-vessels which arise in tumours composed of normal adult texture, such as bone, fibre, &c., are themselves composed of the textures proper to normal adult blood-vessels; but, on the other hand, the blood-vessels of tumours which are composed of embryonic substance are themselves also composed of more or less embryonic cell-forms.

The constitution of the blood-vessels in any growth must be considered when we are endeavouring to throw light upon those conditions which enable a tumour to infect the blood passing through it, so giving rise to secondary tumours in the course of the circulation. There are tumours in which blood-vessels attain to undue proportion, and sometimes tufts of blood-vessel make up almost the whole of a new growth. Such tufts projecting on a free surface bring danger of serious hæmorrhage.

Activity of embryonic cells.

The discovery within a tumour of any large proportion of embryonic cells may generally be taken as a sign of active growing power. Such cells are known by their indefinite transitional shapes, their large nuclei, and many nucleoli. These cells were formerly looked upon as special to the more dangerous kinds of new growth, and were spoken of as "cancer cells." It was thought that one might know a cancer by the presence of such cells.

But you cannot find out the character of a new growth by scrutinising its cells individually. It is true that some kinds of tumour contain a large proportion of cells that are so far peculiar as to be almost characteristic, such as the giant cells in a form of sarcoma, and the lymphoid cells of lymphoma. Yet cells of either of these kinds are met with in other forms of tumour. Indeed, it is now generally admitted that the hope of being able to determine the nature of a growth by the study of detached cells must be given up, and the character of a tumour must be estimated by a general consideration of its whole structure. For experience has established the fact that the structure of a tumour indicates its character. So that dangerous tendencies are constant in tumours of certain construction, such as carcinoma, and are as constantly absent in the case of tumours of a wholly different construction, such as adenoma; whilst in yet other tumours there are lesser degrees of danger.

Character of tumour indicated by structure.

Now in every tumour the new material is developed, like the natural tissues of the body, from embryonic cells. And in any growing tumour

some proportion of such cells is always to be found in the part of the tumour then in the act of development.

But the several kinds of tumour differ exceedingly in the proportion of embryonic and adult material contained in their composition, some appearing to the naked eye to be altogether made up of an adult texture, whilst others are throughout constituted of embryonic substance. And it may be said that the more embryonic substance present in a tumour the greater will be its rate of increase, and generally the greater the danger attaching to it.

Tumours which differ from natural structures—dangerous.

A tumour whose substance differs much from any of the natural tissues is generally a tumour endowed with the embryonic quality of rapid increase, and hence is a dangerous tumour. Whilst a tumour whose composition resembles that of any fully developed tissue, such as bone, fat, ligament, &c., is generally a tumour of slow growth and comparatively little danger. The most important exception to this general rule is in the case of cartilage. Tumours composed of cartilage may grow rapidly, and prove dangerous; but it must be remembered that although cartilage is a tissue of the adult human frame, yet there is such a thing as embryonic cartilage; and thus, indeed, cartilage may claim to be regarded rather as embryonic than as adult.

Tumours composed of adult tissue —simple.

When the substance of a tumour develops into adult tissue the tumour so formed is always composed of one of the proper tissues of the human body, ligament, fat, bone, &c. The tissue thus developed is nearly always the same tissue as that from which the tumour arises, bone from bone, fibre from fibre, fat from fat, papillæ from the papillary layer of the skin, &c. But it must be fully understood that we are here speaking only of primary tumours. For it is most curious, interesting, and suggestive to observe how, when a tumour in any tissue arises as secondary to another tumour in another tissue, the secondary tumour contains the tissue of the primary tumour, and therefore usually the tissue of the seat of origin of the primary tumour. Thus if a tumour arising from the humerus, and containing bone, gives rise to a secondary tumour in the lung, the lung tumour will then probably contain bone. But if primary tumours commonly resemble in microscopic structure the parts they arise in, this resemblance is only reached when the tissue of the tumour attains to complete development. For if the elementary cells of the new growth remain permanently in an incomplete stage, and do not go beyond the form of embryonic cells, the substance of the growth will of course have characters differing from those of the adult tissue wherever it arises, and it may differ exceedingly from the adult form of that tissue.

Indeed, if any primary tumour does not resemble the texture it arises in, this is nearly always because its substance is in an embryonic state or stage. But with this embryonic stage is naturally associated a power of increase, and hence it is that when a tumour does not resemble the tissue in which it grows that tumour will probably prove to be a rapidly increasing, and therefore a dangerous tumour.

How tumours become dangerous.

It is not, however, only through great growing power that a tumour becomes dangerous. The chief danger and the most dreaded danger lies in the tendency of the tumour to prove infectious either to the adjacent tissues or the corresponding lymphatic glands, or to more remote organs and parts of the system.

By infecting the neighbouring textures the tumour will grow again

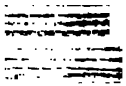
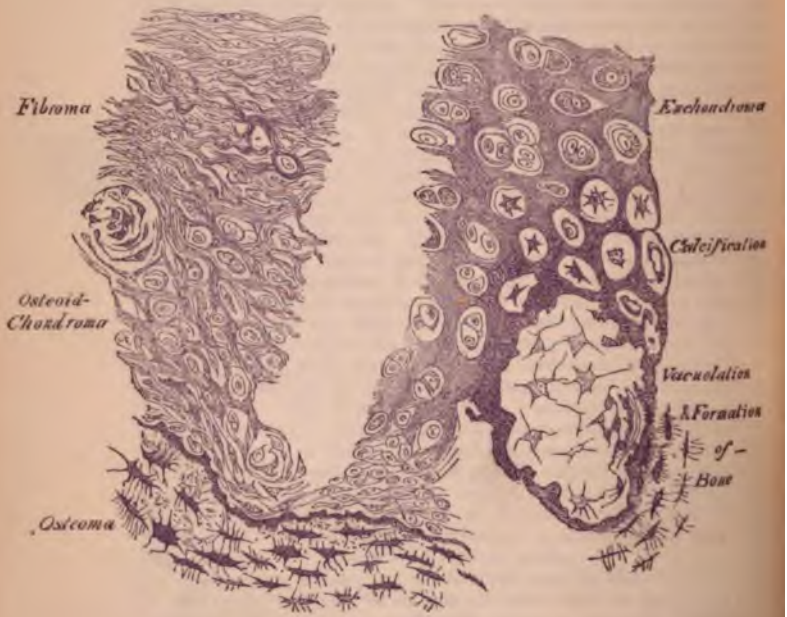


FIGURE 38.

MICROSCOPICAL ANATOMY OF OSTEOMA, OSTEOID CHONDROMA AND ENCHONDROMA.



To face page 195.

rom them after the surgeon has done his best to remove it. By infecting the glands, secondary tumours arise in the seats of those glands; whilst by infecting the walls of blood-vessels, or otherwise setting free its germinal particles in the blood stream, the tumour gives rise to secondary growths in the great vascular viscera, the lungs and liver, or in the cancellous tissue of bones, or generally elsewhere. Infectiveness of tumours.

The possession of this infective power is what is meant by the term malignant, and the word cancer is popularly applied to any malignant tumour.

The microscopic structure of a tumour may throw some light upon its malignant or infective powers. Thus careful inspection of sections of the edges of the tumour may discover that its cells are already spreading into surrounding parts when no signs of their presence is given to the unaided eye. Or it may be found that minute blood-vessels have their walls invaded and transformed by the new formation. A large proportion of juice in the texture of the growth, especially if there be also a large share of easily movable particles, will usually be associated with infective powers. The microscope reveals that these particles are actively growing nuclei and cells. It thus explains the usual rough test by which a tumour is tried for malignancy when the cut surface of its section is scraped, and a milky juice being obtained is held to characterise a cancer.

But the proper manner of judging a tumour is by a thorough examination of its histological structure and a reference of the tumour to its proper structural kind.

General experience has shown the degree of danger belonging to each sort of tumour, and by a knowledge of the structure of tumour its tendency may be fairly inferred. From the histological point of view tumours may be divided into the following groups.

OSTEOMA, OSTEOID CHONDROMA, ENCHONDROMA.

Vide Fig. 38.

When bone forms a large part or apparently the whole of a tumour, the tumour is called an osteoma; but no tumour is ever formed altogether of bone, there is always present an ossifying matrix by the ossification of which the bony part of the growth enlarges. The kind of matrix varies much; thus, sarcomata or even carcinomata may directly ossify, and so we get *osteo-sarcoma* and *osteo-carcinoma;* but the kinds of matrix which produce growths of practically a bony nature are generally two, viz. periosteum and cartilage. Periosteum, or to speak more exactly a tissue resembling closely the deeper layer of the periosteum, forms large tumours whose transformation into bone takes place in the manner shown in the left side of Fig. 38; the cells take the shape of bone-cells, and the matrix calcifies; these tumours are called *osteoid chondroma* or *periosteoma.*

Cartilage often appears to be ossified when it is only petrified by deposit of calcareous salts in its matrix (see right side of Fig. 38); this change is, as is well known, the first step in ossification of cartilage. In many cartilage-tumours the process goes no further, or it may proceed to complete ossification through the several stages shown in the right *side of a figure, viz. vacuolation, formation* of medulla-cells in

the vacuoles, and direct transformation of these to bone-cells, as seen in the lower and right part of the drawing. More rarely the cartilage-cells, without calcifying, proliferate and change directly into bone, as seen in the middle of the figure.

The amount of cartilage, periosteum, or bone, present varies indefinitely in different cases. When cartilage preponderates the tumour is called an *enchondroma;* when bone preponderates, an *exostosis*, *osteoma*, &c., according to its shape and connections; when periosteum preponderates, an *osteoid chondroma*, as before said.

Occasionally the amount of bone and cartilage is so equal that it is a matter of difficulty to decide which name shall be used; and then the terms *cartilaginous exostosis* or *ossifying enchondroma* are employed. *Osteoid chondromata* are to be suspected of malignancy; such tumours compose a part of what were called *osteoid cancers* and now called sarcomata.

ADENOMA.

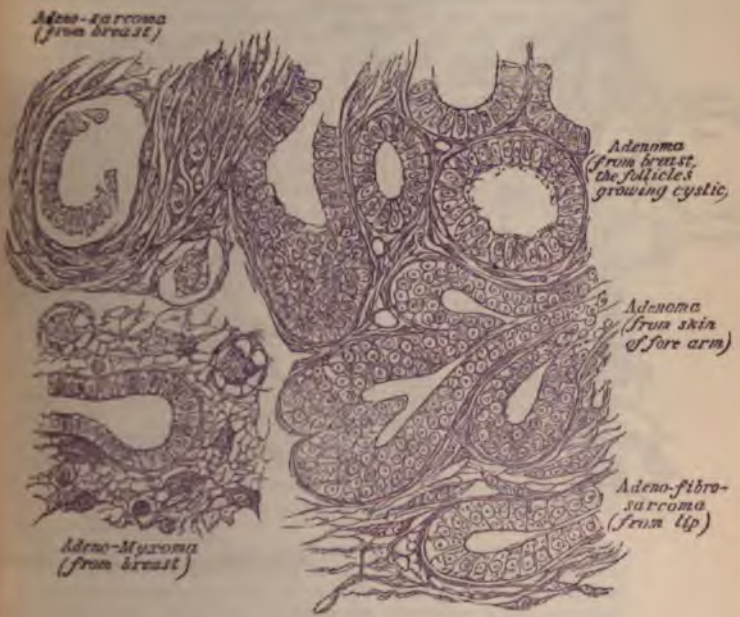
Fig. 39.

The essential character of adenoma lies in the possession of a glandular structure; but the comparative amount of the glandular element varies much. There is also variety in the kind of tissue which is found between the gland-follicles. Some tumours show structure almost identical with that of compound racemose glands, having natural-looking follicles separated by delicate connective tissue; more commonly the follicles are dilated more or less, so as to form cysts; one or more of these may prevail, so as to give a cystic character to the whole (cystic adenoma). Besides the cysts arising in this way, others may be formed by a breaking down of the intermediate tissue, especially if it happen to be mucous tissue. But as a rule the glandular elements are surrounded and separated by a more plentiful formation, which may be so much developed as to more or less entirely take away the glandular character of the growth; this interstitial tissue may either be fibrous, sarcous, or mucous, or more rarely cartilaginous or areolar; or it may present characters combining these or mediate between them (*adeno-fibroma—sarcoma—myxoma*). When the proportion of gland is small, there is doubt whether it is not part of the original gland-tissue persisting in the new substance. Thus, the relative augmentation of the cavities of ducts or follicles may make the tumour take the character of cyst, or the relative augmentation of the intermediate tissue may make it take the character of sarcoma, myxoma, or fibroma; but if the glandular substance is maintained in due proportion, the natural resemblance of adenoma is to carcinoma.

And, indeed, if the glandular substance is maintained in due proportion, then a very little change is needed to give to adenoma the characters of carcinoma. When the characters of carcinoma are studied it will be found that these characters are of the same general description as those of adenoma. In either case there is a meshwork of fibrous or sarcous substance, forming spaces in which cells of a more or less epithelioid type are packed together. The difference is one sometimes requiring close observation and not always to be determined quite satisfactorily, whilst in other cases it is obvious enough. The structural difference between adenoma and carcinoma lies in this, that

FIGURE 39.

MICROSCOPICAL ANATOMY OF ADENOMA.



To face page 194.

FIGURE 40.

MICROSCOPICAL ANATOMY OF LYMPHOMA.



in an adenomatous tumour the glandular epithelium is regular and composed of even-sized and relatively small cells, whose nuclei are generally single and do not contain many nucleoli; the cells do not vary in form, and line the follicles of the adenoid texture in an even and orderly manner; whilst in carcinoma the nuclei in the cells are larger and brighter, and have many nuclei, and the cells vary much in form and size and compose usually compact masses projecting into irregular balls in the sarcous stroma, instead of lining follicular cavities.

LYMPHOMA.

Fig. 40.

The name lymphoma is given to such growths as have a microscopic structure like that of lymphatic glands; in particular, which have a finely reticular meshwork, connected with which are some fixed cells at tolerably regular intervals, not unlike the fixed cells of connective tissue, but generally larger. Within the meshes of this network are numerous cells, which resemble lymph-cells, and hence are also like pus-cells and white blood-cells. The proportion of network to the contained lymphoid cells is variable; sometimes the quantity of fibre is great, and the structure is then like lymph-gland tissue hardened by chronic inflammation. In other cases the proportion of cells becomes very large, while the network grows very delicate and open textured. The fixed stellate cells here appear to multiply, and produce a progeny of the loose movable cells in the meshwork, as if infected by the latter. The whole mass then appears as fine filaments making bold meshes, which are filled with round granular cells, like lymph-cells, but generally larger than these, and having large nucleus, and many bright nucleoli. Such cells at first appear to make up the whole substance, but they easily brush or wash out of the meshes, leaving the network very conspicuous. It will be noticed that the degree of structure here described is very rudimentary. Indeed, sections of *ante-mortem* blood-clot from within a vein (see figure) closely correspond to the description. So also does tubercle in the more recently formed outer edge of it, where its texture is very like blood-clot; hence it is by some classed with lymphoma. Scarlatinous tonsils and typhoid Peyer's patches likewise have lymphoma structure. However, the plan of structure is so meagre that it is not enough to form a bond of union between diseases clinically so remote.

When found in the form of tumours, more properly so called, lymphoma generally takes its rise in the lymphatic glands; those of the neck are especially liable to it, then those of the abdomen and of the mediastinum. It is also found in the alimentary canal, especially the small intestine and stomach, and in the spleen, liver, kidney, &c. Formations of a similar structure have been met with in various organs in leukæmia, chiefly in the liver, in the form of small grains of a pale substance.

Lymphoma may prove malignant, that is, infectious to parts around, especially when the cellular elements are very numerous (in which case the tumour is called lympho-sarcoma by Virchow); it then corresponds to a *part of what used to be included under the* whole name medullary *cancer, which, as formerly used, would include* also soft sarcoma and

soft carcinoma. Indeed, these tumours, when the cell-elements greatly preponderate, become very much like each other, if not undistinguishable as far as their mere structure is concerned.

SARCOMA.

Fig. 41.

The schematic figure (41) is composed of accurate drawings of portions of the several kinds of sarcoma named, but they are gathered together in a diagrammatic way, the forms being graduated into each other as they are when found side by side in the same tumour. You meet, indeed, with all gradations of intermediate forms; for although, as a general rule, one kind of sarcomatous tissue prevails in a tumour, it is far from unfrequent to have more than one of the kinds present together, the characters of each changing into those of the other.

The distinctive histological character of *sarcoma* is the possession of a stroma between the cells, an atmosphere of intermediate matter which surrounds each and is between them all; the qualities of this intermediate or "intercellular" matter determine the kind of sarcoma, as in the class of connective tissues whose developmental stages the several kinds of sarcoma closely resemble. The class of connective tissues includes the several kinds of texture whose office in the body is passively mechanical, either in serving as adjuncts to the muscular system or by filling up interstices between organs of the body or by entering into textures to support their component parts, blood-vessels, &c. Those connective tissues which penetrate into any of the organs of the body are modified in consistence and in arrangement of their elements according to the requirements of the organ. Thus, in the brain the connective tissue, called Neuroglia, is very delicate and soft, and has scarcely any distinctness. Also the connective tissue which enters into the lymphatic glands becomes reduced to very soft fibrillar matter between the lymph-cells. In these instances, and in others, the connective tissue thus comes to have peculiarities and to constitute strongly marked varieties. Yet all connective tissues possess this common feature in their elementary structural composition—that they are made up of cellular bodies between which their proper substance forms an intercellular matter.

The relation of sarcoma to the connective class of tissues appears to be this, that when one of these tissues is produced very rapidly it has no time for its intercellular matter to acquire the proper character, and so remains indeterminate, while it also is small in quantity, the cells greatly preponderating. Thus, any of the normal connective tissues may produce by rapid development a tumour of sarcous tissue or sarcoma (the name is well chosen, σαρξ, which equals *caro* or our word *flesh*, means commonly any soft animal substance, not blood nor bone). Thus it follows that there are several kinds of sarcoma, according to the tissues from which they are developed. The principal of these are seen in the above schematic figure. The round-celled kind generally arise from lymph-gland, or neuroglia, or mucous tissue hence they are common in myxo- or glio- or lympho-sarcoma. The spindle-celled kinds arise from connective, fibrous, or bony tissue, so hence are most common in fibro-sarcoma or osteo-sarcoma.

FIGURE 41.

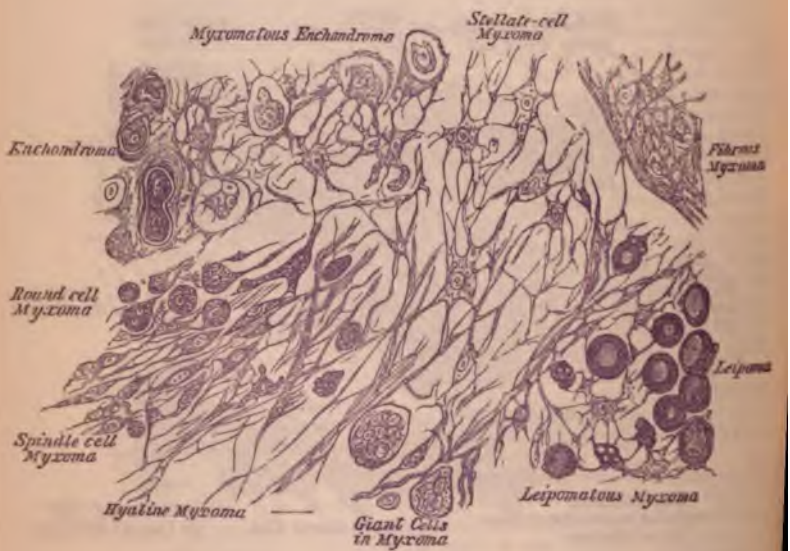
SARCOMA.



To face page 196.

FIGURE 41B.

MYXOMA.



One other form of sarcoma is usually described, the alveolar sarcoma, which is not mentioned here. It is a rare form of tumour, and resembles superficially a cancer or carcinoma. It is formed of a stroma, which maps out large spaces, and these are filled with large round cells. By careful pencilling the characteristic intercellular substance may be distinguished.

MYXOMA.

Fig. 41B.

The name myxoma is given to all tumours of connective-tissue type (not epithelial) which contain mucus or mucin in their intercellular matter. It corresponds nearly to gelatinous sarcoma, collonema, and fibro-cellular tumour of old authors; the forms of the cells are very variable, but in the most typical examples, and especially in the older and fully developed parts, the cells are large and usually multipolar or "stellate," with a distinct nucleus and nucleolus; the stellate branching rays of the cells are mutually connected, so as to form a more or less open network, in the interstices of which the mucous semi-fluid lodges. Beams and bands, which generally have a stiff rigid appearance and an angular rather than a wavy disposition, pass about, dividing up the substance of the tumour into very imperfectly defined sections, more or less visible to the naked eye; from these arise fine fibrils continuous with the cellulo-fibrillar network. Much of the tumour, and especially the younger part, may be found formed of spindle-cells; these are really connected, by threads from their sides, with the intermediate fibrillar network, and it can often be seen that the stellate forms are produced by the drawing out of these threads to greater lengths, through the separation of the texture elements by the increasing quantity of mucus. In yet other examples or parts the prevailing form of the cells is round, or with one pole; the round cells resemble ordinary mucous corpuscles, and are scattered among the fibrils in the mucoid matter; they often contain many fat-grains, and are found in the oldest parts of the tumour, representing the senescence of its cells. There is also a great variability of the intercellular substance, first, in proportion of the fibrous to the cellular part; and second, in the proportion which these solid elements bear to the mucoid interstitial matter; thus, there is a fibrous myxoma, and a clear pellucid variety, with much mucous fluid, perhaps even forming cysts (hyaline and cystic myxoma). In some examples there are large polynucleated cells, identical with the so-called giant-cells of "giant-cell" sarcoma.

In the theory of types, myxoma is affiliated to certain natural tissues, in particular the jelly of the umbilical cord, the vitreous of the eye at a stage of its development, and the early stages of adipose tissue, or to a stage of bone formation out of cartilage. It will be seen that these typical tissues are only transitory in their nature, as compared with such stable tissues as bone, cartilage, tendon. In accordance with this instability of their type, myxomas themselves show many transitions to various kinds of connective tissue; these transitions are chiefly towards cartilage or fat (myxomatous enchondroma, myxomatous lipoma). Tumours are not infrequent, especially in the parotid region, which are intermediate between cartilage and mucous tissue, so that one cannot say to which they most properly belong; also, many

fatty tumours show clear gelatinous patches of mucous tissue in all transitions to fat, while many myxomata show opaque spots composed of true adipose tissue.

CARCINOMA.

Fig. 42.

The term carcinoma is now distinctively applied to such tumours as have a structure of the following description, viz.—A meshwork of fibrous or sarcous substance composing an alveolar structure, whose interstices are filled with cells. These may have no orderly or methodical-looking arrangement, being packed in the crevices in the meshwork (or alveoli, as they are called), and extending casually from alveolus to alveolus, so as to make a complementary meshwork. The carcinomatous character is determined by the presence of such alveolar structure, with cell-collections lodged in it; the decisive point consists in these cells lying close together without any intercellular substance; the cells generally vary in shape, and have large nuclei, with large and bright nucleoli. But often the cells have an arrangement very like the epithelial lining of the follicles of the secreting glands, a structure which may be so well pronounced as to bring them almost into continuity with adenomas; they differ from these chiefly in their history as being infectious, so as to extend into the neighbouring tissues, to the glands, or to the viscera. The structure showing only those minor peculiarities which I have just described.

Five leading types of carcinoma may at present be conveniently distinguished.

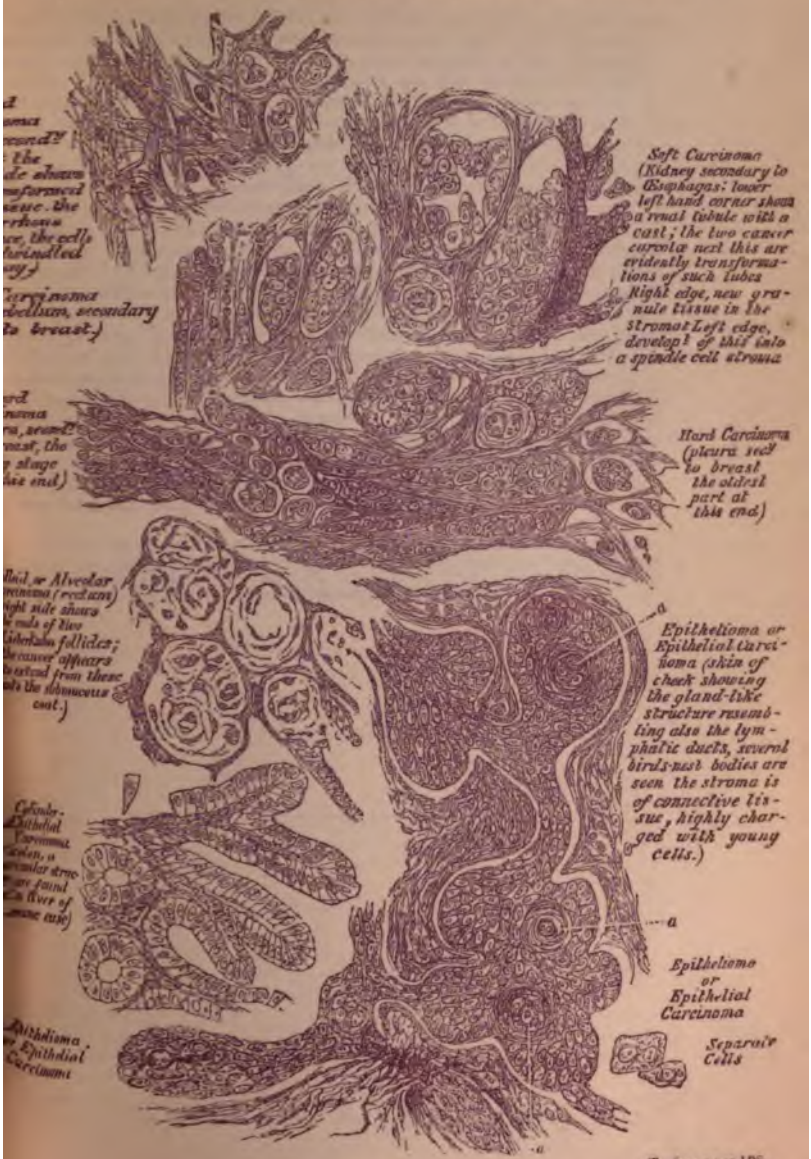
1st. Those in which the fibrous meshwork is in preponderance, and the epitheloid contents of the alveoli are scanty, and, perhaps, also prone to perish early, so that they are found more or less degenerate within the fibrous meshes—Hard Carcinoma, or Scirrhus.

2nd. Those in which the fibrous meshwork is in smaller proportion, and the epithelioid contents are plentiful, making large collections of cells, but with no evident approach in the form of these collections to the shapes of gland-acini, and no evident resemblance of the component cells, either to the columnar epithelium of mucous glands, or the squamous epithelium of cuticle—Soft Carcinoma. This kind occurs especially in glands, and the transformation of the glandular tubes or follicles to cancer alveoli can be seen in all stages in the growing margin of the tumour (see the upper two drawings in Fig. 42, from the liver and kidney).

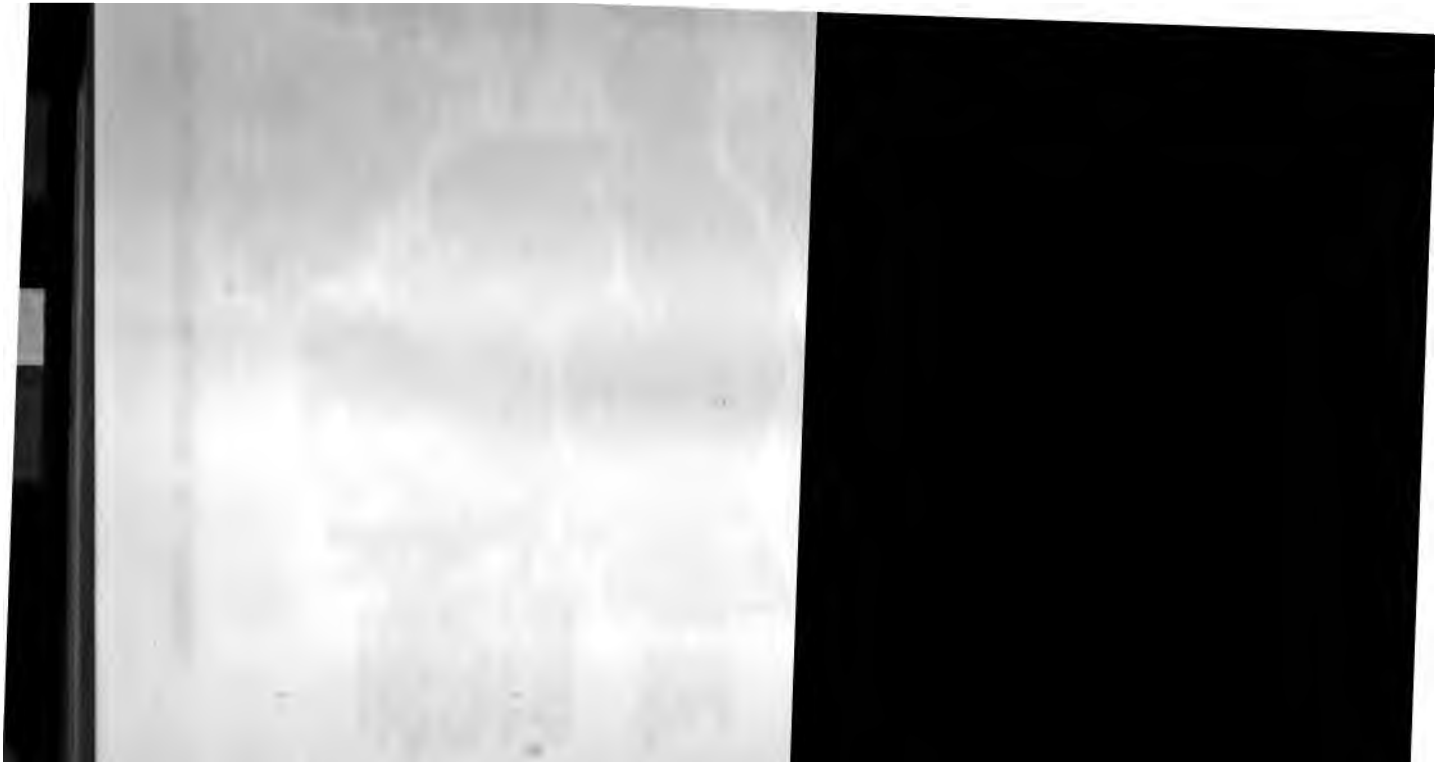
3rd. A structure essentially such as that last described, but with this difference, that the epitheloid cells have a quantity of mucus between them, which is regarded as arising from a transformation of them. This change to mucus may be carried to such an extreme that scarcely any cellular elements are left, while the alveolar meshes in which the mucus is contained becomes very strikingly visible from its nakedness and the pellucidity of the mucus—Colloid, or Alveolar Cancer. A common seat of this is the wall of the alimentary canal, where it may be traced arising from Lieberkühn's follicles.

4th. A structure in which the epithelial cells resemble squamous epithelium, and form masses which are very like the follicles of

FIGURE 42.—MICROSCOPICAL ANATOMY OF CARCINOMA.



To face page 196.



nds, or occasionally like rudimentary hairs; the tubular orms may, however, be seen ramifying like the lymphatic skin, as if their form were moulded to the lymphatic elioma. In these cancers peculiar bodies are found, flattened cells disposed concentrically so as to form a globe (*a*, Fig. 42) whose appearance is like the section of like a bird's nest; these are so large as often to be visible eye; when they are numerous and well characterised, ostic; some authors (Billroth) distinguished a variety of which the stroma preponderates over the epithelial part, rhus of the skin—Squamous Epithelial Carcinoma.
ucture in which the epithelial cells resemble ordinary thelium, and the structure itself is quite like normal brane, in which it always primarily arises (alimentary lly colon, uterus); the secondary formations which occa- in these cases, in the liver especially, have the same thus a tissue like the glandular mucous membrane of the found in the liver—Cylindrical Epithelial Carcinoma.
and fifth varieties are distinguished from the three first cancers or epitheliomata. Some authors have used the for the fourth variety, as though it were not completely hese are less likely to infect the viscera than the first two h are the most infectious of all tumours, though they are being the only kinds of infectious tumours.

Krankhaften Geschwülste,' 1862-5.—*Paget*, 'Surgical Pathology,' 1870. Tumours.'—'Pathological Society Trans.'—*Wilks and Moxon*, 'Patho- Elémens de Pathologie Chirurgicale,' 1868.—*Holmes*, 'System of Debate on Cancer of Pathological Society,' 1874.,

SURGERY OF THE CUTANEOUS SYSTEM.

CHAPTER IV.

CONTUSIONS.

Contusion

A "**contusion**" is an injury caused either by a fall, a blow from a blunt instrument, or severe pressure, in which there is no solution of continuity of the skin. The degree of injury depends upon the amount of force applied and the resisting power of the tissues injured. Healthy tissues suffer little where the soft or unhealthy suffer much. The subjects of hæmophilia fare worse than all others. When the force has been sufficient to produce rupture of the small vessels in the skin and subcutaneous tissue, an "*ecchymosis*" or "*bruise*" is said to exist; when it so injures the deeper tissues as to cause effusion of blood from rupture of some of the larger vessels, "*extravasation of blood*" is said to be present; when the blood effused forms a local swelling, it is known as a "*hæmatoma.*"

After a slight contusion there may be no bruising, but only local pain and swelling, the swelling becoming red, and then disappearing. The wheal that rises after a lash with a whip is the best illustration of this condition.

Ecchymosis.

An "**ecchymosis**" is an effusion of blood *into* the skin and subcutaneous tissue, and it shows itself, according to the force employed and depth of tissue injured, within a few minutes or hours of the injury, as a livid red, deep blue, or black patch, which in the course of twelve or eighteen hours becomes larger and lighter at its margins. About the third day it assumes a violet tint, on the fifth an olive brown, on the sixth a green, on the seventh or eighth it has a yellow aspect, and this fading into a lemon tint then disappears altogether. An ordinary bruise generally runs through all these stages in about two weeks, the rapidity of the process depending much upon the amount of blood effused and the reparative power of the patient. When no blood has been effused into the skin, but "extravasation" has taken place in the deeper parts beneath a dense fascia, the discoloration of the integuments may not appear for three, four, or even fourteen days, while in some cases where the blood has made its way between the tissues, and reached the skin away from the seat of injury, the "ecchymosis" will be at some distance from the spot at which the injury was received, and may not show till late. When much effused blood exists, the swelling will be great.

The *absence* of ecchymosis is no proof that a contusion has not been experienced, since a fatal rupture of deep parts, or of some viscus, may be present without any external signs of injury.

Medico-legal import of bruise.

On making a section of a bruised part, the skin will be found throughout its thickness infiltrated with blood, and firmer and thicker than natural; whereas when the effusion has been the result of violence applied to the body after death the blood will be beneath or upon but not in the cutis, and it will be in small quantities and venous.

Neither *purpuric patches* nor those of "*erythema nodosum*" ought

to be mistaken for bruises. The general diffusion of the spots over the body in the one case, and the history and the general aspect of the other affection, should prevent the error. It should be remembered, however, that in purpuric patients and in "bleeders" a slight blow or pinch may be followed by a severe bruise. Diagnosis from purpura, &c.

A severe contusion may cause a rupture of a large artery or vein, under which circumstances a fatal extravasation may ensue; or it may so crush or pulp the tissues as to destroy their vitality; this a spent cannon-ball may accomplish; or it may so rupture a viscus as to cause death. More frequently, however, a severe contusion causes a separation of the skin from the deep fascia and deeper parts, with more or less extravasation of blood into the split tissues. The effects of a contusion also vary according to locality; thus, in an adult, a blow over the scalp may be followed by a local effusion of blood, and in a child this effusion may go on so as to form a swelling involving more or less of the whole vertex. In the buttocks and loins blood may be so effused as to give rise to a large fluctuating tumour. In the loose cellular tissue of the scrotum or female genitals an effusion of blood may give rise to enormous enlargement, and in the eye every one is familiar with the change. Rupture of vessels after contusion.

Where the extravasation of blood has been extensive, the removal of the clot is a work of time. In some cases the blood remains fluid for a long period, and at length becomes absorbed; in others it breaks down, and gives rise to suppuration. In some, again, it persists for weeks as a large blood tumour, and then suddenly softens down, and is absorbed. In exceptional instances it becomes apparently encysted, and "there is sufficient reason to believe," says Paget, "that blood extravasated in a contusion may be organised, acquiring the character of connective tissue, becoming vascular, and taking part in the repair of the injured tissues," as is seen in the repair of fractures, and in ligatured or twisted vessels. Removal of clot.

Treatment.—A slight bruise if *left alone* and not manipulated will get well, for blood is often rapidly absorbed, as is seen in the eye. *To check extravasation*, cold is the best application in the form of pounded ice in a bag, or a mixture of salt and saltpetre, or the iced poultice,[1] or, what is far better, Leiter's metallic coil (Fig. 8½, p. 48), and in an extremity elevation of the limb with rest. To check any inflammatory action during the progress of the case cold is equally effective. To hasten the absorption of the effused blood, tonics are often of service, and the application of gentle pressure by means of bandages or strappings is valuable. Treatment of contusions.

A lotion of the tincture of arnica, one ounce to a pint of water, or one of the stimulating liniments, such as the soap or opium, seem to have some influence in hastening the absorption of blood.

[1] *Ice poultices*, as suggested by Maissonneuve, are excellent for the local application of cold, and are made as follows:—Take of linseed meal a sufficient quantity to form a layer from three quarters to an inch thick, spread a cloth of proper size; upon this at intervals of an inch or more, place lumps of ice the size of a big marble, then sprinkle them over lightly with the meal, cover with another cloth, folding in the edges to prevent the escape of the mass, and apply the thick side to the surface of wound. The exclusion of air retards the melting of the ice, and the thick layer intervening between it and the surface prevents painful or injurious contact. In injuries to the abdomen this *remedy is very applicable*. *Dr. W. H. Doughty*, of the U. S. A., speaks highly of it. *Circular No. 3.*

Local stimulants.

In cases in which there is extensive effusion of blood, and where the circulation in the part is interfered with, lint soaked in oil and covered with cotton wool is the best dressing to maintain warmth in the part; moist applications are not good.

When incision necessary.

When the blood remains fluid, and is not absorbed, the Surgeon need be in no hurry to interfere, for occasionally interference brings trouble, although when time presses, the use of the "aspirator" to draw off the blood, or rather bloody serum, often expedites recovery. When aspiration has proved ineffectual and a blood-clot remains, this should be evacuated by a free incision, and the exposed cavity irrigated with iodine, boracic acid, or carbolic lotion, and then drained; well applied pressure, and immobility of the part being employed. When the blood has broken up and suppuration appeared, a free incision is essential, the case subsequently being treated as an abscess.

Arrow Wounds.

Arrow wounds.

These, which are punctured and incised wounds, have been made the subject of a special essay by Dr. Bill in the 'American Journ. of Med. Science,' vol. xliv, 1862. He tells us that it is exceptional to meet with single wounds, the American Indians discharging their arrows so rapidly —an expert delivering six in a minute—that if one takes effect it is immediately followed by others. The Washington Army Medical Museum

Of skull.

contains specimens of penetrating arrow wounds of the skull. Where both tables are punctured there is little or no fissuring externally or internally, as the vitreous table is penetrated as cleanly as the outer. "This is in such marked contrast to the results of bayonet or sword thrusts, or of the impact of gunshot projectiles, as to merit notice."

Of chest.

Arrow wounds of the chest are not always fatal; those of the abdomen are generally so. Dr. Bill tells us that the Indians on this account always aim at the umbilicus, and that the Mexicans when fighting the Indians on this account always protect the abdomen.

The velocity of the arrow when first projected is so great that it has been estimated to equal nearly that of a musket ball, but arrow firing is ineffective over a hundred yards. At a short distance an arrow will

FIG. 43.



Piece of buffalo rib pierced by arrow.
Surgeon-General's Office, U. S. Circ. 3.

Of bones.

perforate the larger bones without comminuting them, or will cause a slight fissure only, resembling in these respects the effect of a pistol ball fired through a pane of glass a few yards off. This is well seen in the drawing (Fig. 43).

The wound of entrance in the soft parts is a contused depressed slit, that of exit a mere slit. When an arrow strikes the skin obliquely the wound will be that of a long incised wound.

The treatment of these wounds is thus summarised by Dr. Bill ('International Encyclopædia of Surgery,' vol. ii):

1. An arrow-head must be removed as soon as found.
2. In the search for the arrow extensive incisions are justifiable.
3. An arrow may be pushed out as well as plucked out.
4. The finger should be used for exploration in preference to a probe.
5. Great care must be taken to avoid detachment of the shaft.
6. Healing by first intention should be encouraged.

BURNS AND SCALDS.

On burns and scalds.

A burn is caused by the application of concentrated *dry* heat to the body; a scald, by the application of hot or boiling liquid. As a rule, scalds are less severe accidents than burns, because water, being the ordinary fluid through which the scald is produced, is never hotter than 212° Fahrenheit; yet when any other chemical compound is the scalding medium, the effects are, at least, often as bad as the worst burns. The worst local burn I ever saw was when a man put his booted foot and ankle into a pot of molten lead. The limb came out covered with a boot of metal, and was destroyed even to the bones. Mr. Aston Key amputated the limb at once below the knee, without removing the metal.

A moderate degree of dry heat applied in the pursuit of a calling indurates the skin and blunts its sensibility; and an ironworker or a blacksmith can manipulate pieces of hot iron that would "burn" ordinary people. Thus, some skins or parts of the body are more sentive than others, and, under the same influence, may be differently affected.

Varied effects of heat on body.

The effect of heat when applied to the body, varies according to its *intensity* and the *duration* of its application; it may cause a simple redness of the surface or the death of the part.

First degree.

Thus, its *first* effect is mere *redness* and tenderness of the surface, and after a few hours, these symptoms may subside, the cuticle possibly desquamating.

Second degree.

In the *second degree* of heat inflammation is the result, this action manifesting its presence by the formation of a *blister*, from the effusion of serum beneath the cuticle.

Third degree.

In the *third degree* the superficial layer of the true skin is destroyed, the *surface appearing* of a *grey-yellowish or brown colour*, not painful unless roughly handled. The vesicles that exist contain a blood-stained or brown fluid. The papillæ of the skin, with its nerves, are first destroyed; but, when in the course of a day or so, the dead surface has been "shed," and the nerves exposed, the pain is very severe, and the exposed surface has a reticulated surface.

Fourth degree.

In the *fourth degree* the whole thickness of skin is destroyed, with more or less of the subcutaneous cellular tissue, the parts being converted into a hard, tough, dry, and insensible eschar, mottled with blood; vesication does not exist in this degree, all the superficial tissues having been destroyed. The skin surrounding the eschar may be blistered, but where it comes in contact with the injured part, it will be drawn into folds from the *contraction, owing to* the drying of the *burnt integument; this puckering fairly indicates* the important fact

week, and 12 at later periods; 3, all burns of the scalp, from erysipelas; 3 from pyæmia; and 2 from tetanus. In 11 cases of children cerebral complications caused death, and in most of these the symptoms appeared soon after the accident. In 6 cases inflammation of the larynx proved fatal, evidently from the direct inhalation of the flames; in 12 cases, in which the burn was thoracic, chest complications killed; in 4 abdominal complications proved fatal, and one of these had peritonitis, the result of a deep burn, two had hæmorrhage from ulceration of the duodenum, and one had vomiting from the same cause.

Holmes and Erichsen also dwell upon the fact that cerebral and general visceral congestions are always present in fatal cases; indeed, in all, the congestion is a passive condition, due to the "sudden revulsion of blood from the surface," caused by the skin injury.

Treatment of burns, &c.

TREATMENT.—In all burns, great care should be observed in removing the clothes to save the cuticle. Blisters should be carefully punctured and their contents evacuated, the raised cuticle being gently pressed down to the true skin and covered by dressings. When the patient is cold, or shivering exists, he should be covered with a warm blanket and placed near the fire, some wine or brandy and hot water being administered. Professor Hebra speaks well of the warm bath under these circumstances. When the injury is extensive, one part should be uncovered and dressed before the other, as a free exposure of the suface tends to increase the shock and adds to the pain.

Exclusion of air.

As pain is the constant accompaniment of all burns and scalds, and the exclusion of the air from the injured surface the best means of neutralising it, the Surgeon's object has ever been to find some method of treatment by which this result can be secured, and at Guy's Hospital the application of carron oil, consisting of equal parts of lime water and linseed oil, applied on lint and covered with cotton wool, has long been the favourite remedy, the whole being carefully kept in place by a bandage. At University College the burnt surface of whatever degree, is well covered with the finest wheaten flour by means of an ordinary dredger. At the London Hospital the application of zinc ointment on lint is employed. Dr. S. Gross, of America, uses white lead paint, and more recently powdered clay has been employed. Some Surgeons advocate the use of a lotion of common soda. I have recently been treating burns of all degrees with vaseline and finely-powdered boracic acid spread on lint, with marked success. The dressings must not be changed for some days, not, indeed, until they have been loosened by the discharges or become offensive, inasmuch as the process of dressing any large burn is necessarily painful, and consequently injurious. To obviate the necessity of frequent changes of dressing, carbolic acid has been used dissolved in the oil, in the proportion of one part to ten or more.

Local applications.

In slight cases.

Small burns or scalds may be treated by water dressing, lead lotion, collodion, Friar's balsam, gold-beater's skin, flour, chalk and water, &c. Two parts of collodion to one of castor oil is also an excellent application. In superficial burns this treatment is probably all that is required, the cuticle being re-formed in three or four days, and beyond some increase of redness in the parts the cure is nearly complete. Opium should be given early to relieve pain, and where it is severe the hypodermic injection of morphia should be employed.

When the *first* dressing has been removed and the Surgeon is able to make out the extent of tissue injured as well as the depth of the sloughs that are expected to separate, some stimulating dressing may be called for, to hasten the sloughing process. Carbolic oil, made of one ounce of carbolic acid to a pint of olive or linseed oil, is very effective, or an ointment made of carbolic acid ʒiv, lard ʒiv, and castor oil ʒj; but these drugs will not avail when a very large surface is involved; and, under such circumstances they had better be applied to the sloughing parts, and the vaseline and boracic acid, carron oil, or zinc, resin, or creosote ointment mx of the last to an ounce of lard, to the other parts. A lotion composed of one drachm of the compound tincture of iodine to a pint of water or powdered iodoform is also beneficial. Sloughs, as they loosen, should be cut away, but never dragged. Deep sloughs are well treated by poultices, the turpentine ointment hastening their separation. When the surface is granulating it must be treated as any other open sore, and when the entire thickness of skin has been lost, as in burns of the fourth degree, the Surgeon's closest attention is needed to counteract the contraction of the wound that will take place, thereby preventing the advent of those frightful deformities with which all are too familiar.

Use of carbolic oil.

Sloughs to be removed.

Prevent contraction.

This can be done by extension, applied in some instances through mechanical appliances, in others, by means of bandaging and strapping. When the latter is used, the pressure should be exerted over the granulating surface as well as over the cicatrical border. The strapping must be good and made of linen, thin calico and leather yielding too much; and in the majority of cases nearly all requirements can be met by these means. The process of extension must be kept up during the whole period of granulation and cicatrisation. Thus, in burns of the anterior surface of the neck the chin must be extended to the utmost from the sternum; in those of the thorax the arm must be kept from the side; and where the groin and parts around are involved, the thigh must be kept extended.

In addition to these means, we possess M. Reverdin's method of skin grafting; a practice consisting of the transplantation of small portions of true skin—these centres of cutification not only rapidly growing in healthy granulations, but having the power of imparting to the margins of the granulating tissue a skin-forming power which is as remarkable as it is beautiful to witness.

Skin grafting.

By these means large granulating surfaces may not only be rapidly healed, but healed without such a surface of cicatrical tissue as necessarily exists after ordinary burns or scalds, and, therefore, without that tendency to subsequent contraction that appertains to cicatrices.

When a hand or finger, foot or toe is charred, amputation must be performed; and where the soft parts are so injured as to slough, the same practice may be called for. The time and also the necessity for operation in any patient's case must be left to the judgment of the Surgeon.

When amputation necessary.

The constitutional treatment of burns in the first stage is to *prevent collapse* by the judicious use of stimulants and external warmth; *allay pain* by local treatment and soothing drugs, such as chloral or morphia; *sustain the powers of the patient* by simple nutritious food, such as milk, beef tea, eggs, &c.; and *after* the stage of reaction, when that of suppuration has set in, to prescribe good food of all kinds and tonic medicine.

Constitutional treatment of burns, &c.

Complications are to be treated on ordinary principles, understanding that the injury is depressing, and requires no additional lowering influence in the way of treatment.

Thoracic complications may be dealt with by moderate doses of tartar emetic and salines, as well as nutritious and possibly stimulating diet.

Abdominal complications, with opium, alkaline remedies such as lime water in bark, and simple diet.

For children an opiate is best given in the form of the opium ointment; while for adults, where the drug upsets digestion, the same plan is equally effective.

Scalds of the glottis will be considered in Chapter XVIII.

Effects of lightning.

Burns and accidents from lightning rarely occur in this country, and average about twelve a year. In 1861 there were twenty-six, in 1862 twelve, in 1863 three, and in 1864 six. Holmes, who has written a careful compilation on the subject, tells us that a person struck by lightning is usually more or less completely deprived of consciousness at the time. In many cases this is not so, as in a remarkable example which occurred in the practice of G. Wilks ('Clinical Society's Trans.,' vol. xiii, 1880). This is sometimes a consequence of the shock given to the brain, and is accompanied by more or less paralysis of motion and of common or special sensation. Occasionally, and perhaps more usually, it is merely the effect of fright, and is then only transient. This insensibility sometimes lasts for a considerable time. The paralysis by which it is usually accompanied may last for an indefinite period; in one case it lasted four months, in another three. It is more common in the lower than in the upper limbs. Other affections caused by lightning are burns, eruptions of erythema or urticaria, loss of hair over parts or the whole of the body, wounds, hæmorrhage from the mouth, nose, or ears, loss of sight, smell, speech, hearing, and taste, or, in rare cases, exaltation of these special senses, cataract, imbecility, or abortion. It sometimes leaves arborescent marks on the body even on parts covered by clothes, which have often been described as a kind of photograph of neighbouring trees or other subjects. Persons not killed on the spot usually recover, though some die from exhaustion; recovery can be hastened by tonic treatment; and galvanism is beneficial in paralysis. Burns caused by lightning are deep and obstinate; sometimes, however, they are mere vesications; and should be treated as other burns.

Treatment.

In Wilks's case the man was thrown down and stripped naked of a well made suit secured with straps and buckles, and stout new hob-nailed boots. The clothes were stripped into shreds and boots burst asunder. The man was burnt superficially where the flannel touched the skin, but deeply where the cotton trousers were in contact. He had also a compound fracture of one leg. Wherever there was a piece of metal (waistbelt, watch, boots) there was an explosion, or at least a greater development of heat. The man recovered completely.

In sudden deaths from lightning the shock to the brain is the cause; the heart is found flaccid and empty, the blood sometimes coagulated; and Taylor tells us, from Sir C. Scudamore's experiments, that in animals killed by electricity the same conditions existed.

The Diseases and Treatment of Cicatrices.

Cicatrices or scars however produced, grow with the growth of the individual, and, at the same time, have a tendency to disappear, so that indurated scars may indeed, in time, become non-indurated. In small scars this is often observed, and even in larger it is so occasionally, the large cicatrices of burns becoming soft and pliable. As often as not, however, the opposite occurs, and the disposition to contract is very formidable, producing deformities of a frightful kind; those of the neck being, perhaps, the most hideous. The arm may be fastened to the

On cicatrices.

Disposition to contract.

FIG. 44A.



Axillary cicatricial web after burn.

FIG. 44B.



Mode of applying extension after its division.

side (Fig. 44A), and I have seen in one case the head of the humerus displaced forwards beneath the clavicle, and in a second beneath the coracoid process and the development of the upper extremity arrested by the contraction. There is no limit indeed to the effects of such a powerful and constant force as that of cicatricial contraction.

The Surgeon is called upon not unfrequently to remedy these defects, and where his efforts are successful, the Surgery is satisfactory, but too often the result is far from what is required.

Operative measures.

The operation consists in the free division of the cicatrix and its adjacent tissues; the subsequent extension of the divided parts during the healing process, and the transplantation of different centres of "cutination" during the granulating stage, after the method of Reverdin.

In dividing the cicatrix the incision may be directly across the scar, running into healthy tissue on either side, or in the form of a natural inverted V, according to the line of induration, the V flap being dissected from the tissues beneath; or a number of small incisions may be made, subcutaneous or otherwise. But in all these divisions the Surgeon must remember that the seat of the contracting cicatricial material is in the subcutaneous tissue as well as in the skin, and that unless it also is divided no permanent good can be expected. It is on this point, and indeed upon it alone, that a prognosis can be based. The most favorable cases *for operation are those in* which a web of tissue *connects an extremity with the body, or the chin* with the chest, for

Modes of performance.

such a web contains within itself most of the cicatricial material upon which the deformity depends, and on its division the whole will be freed. Great care is needed, however, in the division of these webs, for they often contain important parts, such as nerves and vessels that have been displaced by the contracting process. Thus, in treating a case in which the right arm was fixed by a web from the axilla and elbow to the chest, the web seemed to be so cutaneous that I was half tempted to perforate with my knife and slit it up. Had I done so, in the position I had noted, I should have passed my bistoury across the brachial plexus, artery, and biceps muscle—these parts having been completely drawn across to the thorax by the affection—and then been forced to amputate the extremity. I did, however, what I should always advise others to do—divide the parts carefully and deliberately, and thus steered clear of any harm. I brought also a piece of healthy skin from the posterior part of the wound and fixed it to the anterior, about the lower border of the axilla, thus dividing the large exposed surface by a bar of healthy integument, and kept the arm at a right line to the shoulder with a splint extending from the elbow to the hip. When the wound had assumed a healthy aspect I inserted ten pieces of skin the size of hemp-seed, and after this, cicatrisation went on with wonderful rapidity, the child recovering with a useful arm and movable cicatrix. In this case I have fairly indicated the points requiring attention to secure a successful operation.—Free but deliberate division of the cicatrix and subcutaneous tissue; extension from the first during the healing process, by some fixed mechanical appliance; and skin transplantation when the surface of the sore has assumed a healthy granulating surface; the Surgeon, where he can, partially detaching a piece of integument from one side and connecting it with the opposite, in order to divide the wound, and thus increase its skin margin for granulation. Where a bend in a joint exists this practice is still more valuable. After the operation the wound should be dressed with vaseline on lint and covered with cotton-wool, as in a burn. Fig. 44B illustrates a simple method of applying extension of the arm after the division of an axillary cicatrix of great size, and Fig. 45 illustrates the effects of a burn upon the neck.

Example.

Danger of perforating web.

Points to be observed in operation.

FIG. 45.



Effects of burn on neck, contraction of cicatrix.

In *deformities affecting the jaw*, in which immobility of the bone has been produced, Esmarch and Rizzoli have proposed the division of the bone and the excision of a small wedge of bone at the fixed side with a view of making a false joint. The operation is a sound one, and

Section of jaw in deformities.

has been accomplished successfully by Mr. C. Heath and others. In suitable cases it should be repeated.

Ulcerating cicatrices

Ulcerating cicatrices are not uncommon, for "new cutis and new formed granulations are neither so strong, nor have they the living principle so active in them as the old cutis" (John Hunter, 1787), and an old scar may break up and become the seat of an indolent sore when its possessor has been weakened by any fever or exhausting process, in the same way as old subcutaneous cicatricial tissue may give rise to a residual abscess. I have seen this repeatedly occur in adults, in cicatrices formed in infancy. In one case the cause of the scar was a burn, in another an injury, in a third an operation, but in all, the scars were alike, and they underwent the same degenerating process. These sores require to be treated by rest and local stimulants, the patient receiving tonics and good food to improve the weakened powers. In one case I transplanted with complete success. These "cicatricial sores" are, however always obstinate, those over the ends of bones being unusually stubborn.

Warty and cheloid scars

Warty and cheloid scars are classed together, because it is difficult to distinguish the indurated, lumpy, warty scar from the true cheloid. The former, however, appears directly *after* the wound has healed, and is clearly connected with the healing process, while the latter attacks any scar at any period of its existence.

The thickened warty scar appears as an induration of the whole cicatrix and is often associated with heat and irritation. It is best treated by local stimulants, such as iodine or blistering fluid—the object being to break up, by some local inflammatory process, the lowly organised fibrous production.

On cheloid tumours.

Cheloid tumours grow as indurated smooth tubercles, at first having a red or pinkish colour, but as they increase becoming pale. They are at times painful, or, at least, irritable, and rarely attain a large size. They had better be left alone, for they are apt to return in the cicatrix formed after their removal. Cheloid tumours generally grow from cicatrices. These cheloid tumours are known as those of Alibert, to distinguish them from those named after Dr. Thomas Addison, who in 1854 ('Med.-Chir. Trans.') described another form of cheloid which he calls the "true cheloid," the induration beginning in the skin and subcutaneous areolar tissue, and often going on to produce such a contraction of the part affected as to resemble the indurated cicatrix of a burn. Figs. 46A and B represent the two affections.

The cheloid tumour which follows the perforation of the ear for an ear-ring is a curious form, and seems less liable to return than others of a like nature. From the deformity it causes it should be excised with a portion of the healthy lobule.

Cancer may attack scars.

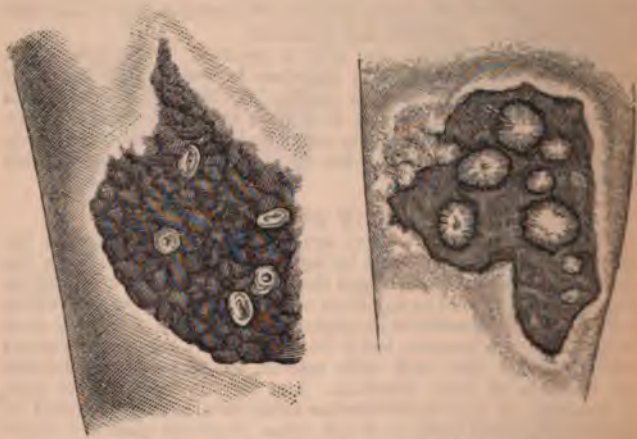
Cancer may attack a scar, and when it does so the scars are generally old. Thus, I have treated a man who had a cancerous lip, the disease having developed in a scar he had had for fifty years. It began as a thickening of the scar, and then showed itself as a tubercle, which grew, broke down, and ulcerated, the ulceration rapidly spreading.

Examples.

In December, 1871, I was called upon to amputate above the knee in a man, æt. 58, a leg stump that was the seat of a frightful cancerous disease which had existed for two years, and had appeared in the cicatrix of an old amputation performed fifty-four years before for gangrene after fever (Fig. 32).

the sore connecting links of new skin rapidly form, which divide the sore into sections (Fig. 48A and B). By these means large surfaces speedily cicatrise, which under former circumstances would have required many months.

FIG. 48A. FIG. 48B.



Drawing illustrating the cicatrisation of sores by skin grafting.

Moreover, the contractions and subsequent deformities that under other conditions were too well known to follow in such cases do not occur.

When applicable.

The practice seems applicable wherever a large granulating surface exists, and in its adoption the only desirable point to observe is, that the *surface of the sore should be healthy*; this clinical fact includes another —that the patient's health is good, for there is no better barometer of health than a sore, its surface assuming a healthy or unhealthy appearance with every alteration in the general condition of the body. I have attempted, however, by way of experiment, to graft skin upon sores that were not quite healthy, and have sometimes succeeded. In some indolent sores, in which a small patch of healthy granulations sprang up, I have succeeded in securing by transplanting a new centre of "cutification," which proved of great value in aiding the healing process; in some others the graft has been enough to excite a more healthy action in the sore; still in many, poor success followed the practice. It may, therefore, be accepted as a truth, *that a healthy granulating surface is an important although not an essential requisite for success in skin grafting.*

Upon this basis I now proceed to consider how the operation is to be performed.

Pollock tells us that Reverdin's method is to remove a very minute portion of the skin, place it on the surface of the granulations, and there retain it with a strip of plaster. He writes, "I have usually

removed the skin by nipping up a very small portion with a fine pair of forceps, and cutting it off close with sharp scissors. At first I made a slight cut in the surface of the granulations, and then embedded the piece of skin; but of late I have only laid it on the surface of the ulcer. I cannot say that I have found any difference in the result. I do not think there is great, if any, advantage to be gained by the transplantation of a large piece, but where the ulcer is large I think much is gained by the transplantation of numerous small pieces. The disadvantage of transplanting a large piece is the sore it creates; while the small sores formed by the removal of the minute pieces heal in a short time, and without trouble." ('Clin. Soc. Trans.,' vol. iv.)

My own experience in every point confirms that of Pollock.

FIG. 49.



Scissors for skin grafting.

For the removal of the sound skin I either employ a pair of scissors (figured above) which Messrs. Krohne made for me after Macleod's suggestion in a medical journal, or a fine lancet, after the elevation of the skin upon the point of a needle. I generally take the skin from the fore part of the arm or the side of the thorax. Mode of performing transplantation.

Having taken away the skin, the fragment should be cut into three, four, or more pieces, and these placed about *half an inch or three quarters of an inch from the margin of the sore, and about one inch apart;* for there is no doubt that the engrafted centre has a stronger influence in exciting a healing action in the margin of the sore when placed near it, than when isolated in the centre of a granulating surface. Where to place fragments.

The pieces should be placed upon the granulations, and gently pressed in. There is no necessity to wound the granulating surface. They should be covered with a piece of oiled gutta-percha skin, and the whole supported with cotton wool; a bandage being subsequently applied, so as to press moderately upon the part, and keep the dressing in position. On the third day, but not before, the dressings may be removed with the greatest care, and a fresh piece of oiled gutta-percha skin should be subsequently applied. Not to change dressing till third day.

The appearances of the engrafted pieces on the removal of the first dressing vary considerably. At times they will seem palpably to have taken root and be alive; at others to have disappeared altogether; whilst in a third class the surface of the cuticle will be seen floating, as a thin film, upon the secretion of the sore, the basement membrane of the cuticle—the essential *part—being left (Fig. 48A).*

Under all these circumstances, however, the surface of the sore is to

Care in removal of dressing.

be cleaned with the greatest care, a stream of tepid water, from a dressing can or squeezed from a sponge over the part, being the best means to employ. The surface is on no account to be wiped, for the grafted portions of skin are easily uprooted, whilst those that seem to have died or that have disappeared often show themselves again later as "cutifying centres." As soon as the new centres are established in large sores, other pieces should be engrafted, at about the same distance from the new pieces as those were originally inserted from the margin of the sore; and in this way the whole granulating surface may be speedily covered with new skin, and a rapid recovery follow.

How grafts stimulate margin of sore.

How the engrafted pieces act in the healing process is now satisfactorily settled, for experience has proved that the grafts not only grow themselves by cell proliferation, but they stimulate the skin-forming powers of the margin of the sore, for as soon as the "grafts" have taken, the margin of the sore nearest to them is seen to cicatrise and to send out prolongations of new cicatrising tissue to meet similar prolongations from the new cutifying centres; the sore in this way becoming subdivided by bands into smaller sores, and then rapidly healing (Fig. 48 B).

FIG. 50 A and B.



Drawings illustrating the growth of black skin when grafted on to the sore of a white man.

How engrafted pieces grow.

That the engrafted portions grow by the proliferation of their own cells is likewise proved by the fact that in the case of a white man upon whose granulating ulcer I engrafted four small pieces of black skin, the whole being no larger than a barley-corn, the black skin grew twentyfold in ten weeks, to the extent illustrated in Fig. 50 A, the grafts subsequently enlarging and sending out prolongations which joined to form one patch of black skin (*vide* Fig. 50 B). The sore healed as rapidly where the black skin was grafted as where the white was placed.

Pieces may be transplanted from amputated limbs.

The same result may likewise ensue when large pieces of skin are transplanted from the patient or from some recently amputated limb. But there seems to be no advantage in this practice, and in the cases in which it has been adopted a large proportion have failed. In a case of mine the grafts took root and excited a healthy action in the margin of the sore; they, however, grew but little, and remained on the cicatrix of the sore, as bosses of skin with well-marked borders. They were grafted, it is true, but the grafts seemed to have no power of assimilating themselves to the tissues on which they were placed (*vide* Model Guy's Mus.). When this practice is adopted the pieces of skin on removal should be dropped into warm water in their passage to the wards where they are applied.

Not required to take large pieces of skin.

To take large pieces of skin from the patient's own body is an objectionable practice on account of the large wound it creates, and, moreover, is unnecessary in the majority of cases, as small pieces appear to do better. To take them from another subject is also objectionable for like reasons; but still more so from the risk that is necessarily run of introducing into the blood of the living subject some new or poisonous element; a risk to which I think a patient should not be subjected, and that I would not allow on myself. For these reasons I have forbidden my dressers adopting the practice.

Risk in transplanting skin from other subjects.

In the case where black skin was transplanted I did it with the full concurrence of both patients; indeed, both were rather disappointed that the operation could not be repeated. They were firm friends, and the link I formed bound them closer!

May cut the piece into minute fragments.

There seems to be no objection to dividing the portion of integument which is to be employed into minute fragments, that is, into pieces the size of millet-seeds; the thumb-nail of the Surgeon being the best table for the purpose. In children, where it is unadvisable to remove much healthy skin, and the granulating surface to be covered is large, the plan is excellent, though I prefer pieces the size of half a hemp-seed, when they can be obtained. The practice of applying "skin-dust," or the products obtained by scraping the skin, cannot be recommended, as it is rarely successful.

Properties of the newly engrafted skin.

Whether this newly-engrafted skin possesses the same power of resisting disintegrating changes as the old skin is not yet proved. Some observations I have made lead me to suspect, that it is in some cases rather liable to break down and ulcerate as soon as the patient begins to walk after the sore has completely healed, whilst, in others, I have found a sore in this way healed, is more capable of resisting disintegrating changes than another healed by unassisted natural processes. At any rate, it is necessary to observe as much care in the after-treatment of the case as ought always to be observed after the cure of any other sore; and more particularly to afford moderate support and protection to the part. For this purpose there is nothing better than to bind on a piece of sheet-lead over the cicatrix when the seat of mischief is on the leg, as by it equal pressure as well as protection is afforded.

The new skin soon becomes as sensitive as the old; the sensibility of the cicatrix, under these circumstances, indeed, seems to be greater than when unaided cicatrisation is allowed to take place.

Sponge Grafting.

Sponge grafting.

Dr. *Hamilton, of Edinburgh, introduced this* practice into surgery

'Edinburgh Med. Journ.,' Nov., 1881.

with a view of expediting the repair of deep wounds, in which much loss of tissue has taken place, and he did so "thinking that sponge would imitate the interstices of the fibrinous network in a blood clot, or in fibrinous lymph," and that the blood-vessels of the new surrounding tissues would push into these interstices and grow and so fill up the cavity, the sponge eventually becoming absorbed. He gave cases which were apparently successful, and many have been recorded since.

How to prepare sponge.

To carry out the practice a fine section of sponge should be applied to a healthy granulating surface, and the sponge covered with oil silk. A layer of lint saturated with carbolic or terebene oil should then be applied, and the whole wrapt in some antiseptic gauze, or boracic or salicylic wool. The dressing should be removed every second or third day, according to the quantity of discharge. The sponge is prepared by being steeped in diluted nitro-muriatic acid, to dissolve the silicious and calcareous salts, and later on washed in a solution of ammonia or potash to remove all excess of acid. Before being applied it is purified by prolonged treatment with a five per-cent. solution of carbolic acid. In the original paper Hamilton recommended thick sections of sponge; he now uses fine ones, fresh layers being consecutively applied as granulation tissue grows. I have employed sponge grafts on many occasions, and have seen more cases in which the practice has been carried out, and I can testify to the fact that the sponge becomes as it were incorporated with the granulation tissues, but whether it really expedites repair or not, or becomes of any practical value in the repair of deep wounds, I am not prepared to say.

Chilblains.

On chilblains.

Chilblains are local inflammations of the skin, and are to be met with in subjects of a feeble circulation. They are more common in the young, and in women than in men, and are generally seen on the toes, fingers, nose, or ears, and are caused by any sudden change of temperature or any sudden application of cold or warmth.

They show themselves as simple congestions of the skin attended with tenderness or itching; vesication of the skin, when the inflammation is more severe; or sloughing and ulceration of the skin, when a broken chilblain occurs. The disease may begin and stop at the first or congestive stage, or run through all the stages.

Towards evening the symptoms of irritation are always increased, and any external warmth, as of a fire or bed, any full diet or stimulating drink aggravates them; in fact, anything that excites the circulation in the part, at any hour of the day or night, is apt to increase the symptoms.

Treatment of chilblains.

TREATMENT.—The local treatment of chilblains is no less important than the general, and more successful; for whilst tonics, good diet, external warmth, and exercise are necessary to improve the general powers of the patient and the circulation, local stimulants are of great value. When the chilblain is not broken, the local application of the tincture of iodine, of a solution of sulphate of copper (three grains to the ounce), of camphor liniment, of soap liniment with opium or one fourth part of the tincture of cantharides, of compound tincture of benzoin, or of simple spirit, not only gives comfort, but hastens the cure of the disease. The parts should also be covered with strapping spread on leather.

When the parts are broken, vaseline, boracic-acid ointment, with the

use of thick lint and oil silk or elastic tissue, are the safest remedies, stimulating lotions being used later when the parts are indolent in healing, such as terebene and oil or carbolic oil with opium.

Warm socks and loose shoes or boots are always indicated, but anything like pressure is most detrimental. Exercise also should be taken when possible, and an equable temperature ought to be maintained.

Frostbite.

On frostbite.

It has already been shown that the sudden application of cold to any exposed part of the body of a feeble or depressed subject is liable to be followed by "*chilblain*;" and, when concentrated cold is applied, under these circumstances, for a period sufficient to arrest the circulation in a part, a "*frostbite*" is the result. Sudden and severe alternations of heat and cold under exposure, even in healthy subjects, may produce this result; in military life this fact is well known.

Local effects.

The first effect of cold upon a part is, a sense of numbness and weight with a feeling of tingling. To the eye, the skin will probably appear redder than usual, and if the part be removed from the influence of the cold at this time recovery, or, in feeble subjects, a superficial "*chilblain*" may follow. If the cold, however, be allowed to act longer, the parts will become stiff, and at last insensible, feeling "dead." To the eye they will assume a white and waxy aspect and be senseless to all impressions, the blood having been completely driven from the surface. When the cold has been suddenly applied, and is sufficient to kill the structure outright, the frozen part will have a mottled aspect, from the retention of blood within the tissues. Many of these effects may be produced by the æther spray.

First degree.

Second degree.

Third degree.

Constitutional effects.

The *constitutional effects* of cold are at first stimulating, and subsequently depressing; excitement passing into sleepiness, and this into torpor. If the latter be yielded to, the sleep will end in death, the blood being sent from the surface of the body to the brain and other viscera, and death being produced by blood engorgement, as in apoplexy.

In the "sleepy and depressed stage" of cold, if the patient be brought suddenly under the influence of warmth, and placed too near a fire, the risks of lung engorgement, as well as of rapid gangrene of the frozen parts, are very great, for by sudden reaction the arterial circulation becomes quickened when the parts gorged with blood have lost their power of propelling onwards. In gangrene from frostbites there seems reason to believe that ulceration of the duodenum may follow, as after burns. Mr. Adams has recorded such a case in the 'American Med. Times' for 1863.

Treatment of frostbite.

TREATMENT.—Any sudden alternation of temperature being most injurious, the aim of the Surgeon should be to recall the affected parts *gradually* to their normal condition, *firstly*, by assisting the venous circulation by gentle friction in the course of the veins with furs or flannel, and, *secondly*, the arterial by comparative warmth applied externally, and gentle stimulants administered internally. Neither warm water, nor air, nor fire should be allowed to approach the parts until the natural temperature has been partially restored, and then only with great care. Friction with snow or iced water is most useful. On reaction, the parts may be raised and lightly covered with flannel or cotton wool, or exposed to the warm air of a chamber; whilst food and stimulating drinks are carefully administered, warm milk with a little brandy

being the best. Should reaction be too severe, it must be checked by lead or spirit lotions.

When gangrene limited.

When gangrene follows, and it mostly does when the third degree of freezing or the mottling stage has been reached, and only *small* portions of the body suffer, such as the integument, the parts may be dressed by some stimulating application, to hasten the separation of the slough, and should be kept warm. Carbolic acid and oil are probably the best applications; tonics should also be given.

When gangrene extensive.

When *large* portions of the body suffer, such as the whole foot (and in this country I have seen a coachman, who had on new tight boots on a bitter winter day, lose both feet), amputation may be called for, the Surgeon always waiting till the line of demarcation or limit to the sloughing process is fairly marked.

Boils.

On boils and carbuncle.

Boils are, in a measure, allied to carbuncles, and both are due to inflammation of the skin and subcutaneous tissue, though the disease probably commences in the latter. In both, there is effusion of lymph into the areolar tissue of the part, and in both, this generally sloughs, although in the boil, the slough is local and confined to one central point, while in carbuncle, the process may cover an extent of integument varying from the size of half a crown to that of a plate.

Boils of two forms.

Boils are met with in two forms: *one* as a subcutaneous affection, attended with little pain until the skin over it inflames and suppurates. It then appears as a conical-pointed swelling, with inflamed indurated areola; this causes severe distress, until the parts give way, when the feeling of tension and throbbing is followed by relief due to the termination of the sloughing process, and discharge of the "core." When the slough has been discharged, an irregular orifice in the skin is seen covering in a cavity in the cellular tissue, which subsequently granulates, leaving a depressed and indurated cicatrix. The core or slough is composed of skin infiltrated with lymph.

The *second* form of boil begins as an inflamed follicle or pimple, which occasionally becomes vesicular, and has a scarlet, exquisitely sensitive areola. It suppurates slowly, and, as a rule, terminates with a less well-marked slough than the former kind. Such boils are more usually multiple than the other, and are often caused by the application of moist dressings, or of some cadaveric irritant.

Causes of boils.

With respect to the *causes of boils*, nothing definite can be laid down. That they are always associated with some debilitating or allied cause is belied by daily experience, for they are certainly often seen in men and women in whom no such condition exists, and in subjects who often declare that they "never felt better in their lives." As a rule, however, this is not the case, because they more commonly occur in subjects who have either been fed to excess or been subjected to some sudden change in the nature of their diet; such for instance as in men who undergo training for athletic pleasures, or who are subjected to the influence of fœtid animal exhalations, as met with in a skin-yard, pathological room, or dissecting-room. They are seen also in the diabetic and cachectic subject, as well as in patients enfeebled by any fever or other debilitating cause. Gamgee tells us that they are often the result of eating diseased meat. They are also produced by the local contact of certain cadaveric emanations; the newly appointed post-

clerks of our hospitals often falling victims, the poison first as a direct irritant upon the follicles to which it is They are far more common in some years than in others. In ho are predisposed to their formation any local irritation is dnce them, such as the friction caused by rowing, the applica- poultice, water dressing, strapping, or a blister. They attack ument of any part of the body, the palms of the hands and he feet being apparent exceptions.

dense integument of the nape of the neck, buttock, and out- e thighs, they are more chronic and painful than in the skin texture. They are troublesome local affections, but seldom life. In rare instances they are followed by septicæmia and t only in one instance have I known this to occur.

MENT.—The general treatment must depend upon the con- the body and the apparent cause of the complaint, any un- e habit being corrected, and any evident want supplied. ther circumstances the practice must be directed on general s. The diet should be nutritious, but not too stimulating, short of fatigue should always be allowed, and fresh air obtained sible. The secretions should be looked to, and, when out of rrected, mild laxatives being often of service. When the skin ng unhealthily, the Turkish or warm bath is of great benefit; , alkalies or acids ought also to be given when the condition of ch needs them; alkalies and bitters are often of great benefit. debility exists, quinine is invaluable, and in London or large combination with iron is required. When diabetes is present, feeding" treatment is probably the best. Dr. Jackson, of the tates, gives twelve to sixteen grains of quinine a day, increas- dose daily until its special effects are produced, and then de- it. He continues the treatment for a month. Yeast in doses le-spoonful, taken fasting three times a day, occasionally to have a rapidly marked beneficial effect, although in what ts it is difficult to say.

cal treatment must be directed much by the local symptoms, as a rule, a better course to let the boil discharge itself or dry to lance it. In the early stage of the papular or follicular boil, the free application of alcohol, spirit of camphor, the f silver, liquor potassæ, or iodine tincture, is often followed by pearance; but in the other kind all such applications are worse less. Covering up the areola of the boil with a perforated piece r is a good practice. At times, painting the areola with col- colloid styptic answers well.

the pain is great from the tension of the part, and the areola mation is spreading, relief may generally be given by lancing; n the slough is slow in separating, the introduction into the of a point of potassa fusa is followed by the rapid cleansing of d and its granulation. Poultices may be applied for a limited aring the sloughing stage, but not for any length of time, as n encourage the appearance of others. When boils succeed her *seriatim*, without any definite cause, change of air is a cessful remedy.

Treatment of boils.

Constitutional.

Diet.

Quinine.

Yeast as a medicine.

Local treatment.

Incision to relieve tension.

Carbuncle.

On carbuncle.

is a far more serious affection than a boil, for it is almost

always met with in the feeble and cachectic subject, and generally in men, rich or poor, over forty-five. It is very frequently associated with diabetes, and gouty patients are particularly prone to its attack.

It generally occurs singly, and is slow in its progress, the inflammation in the skin and cellular tissue beneath spreading as a brawny inflammatory effusion, with no defined border. The redness of skin is rarely vivid, more frequently livid; at times the local pain is severe, and constitutional depression very great. The sloughs separate slowly, many openings, as of many boils, allowing them to escape, and the whole skin at times separates as an ash-coloured layer, leaving an irregular cavity undermining the neighbouring tissues. The favorite seats of carbuncle are the skin and subcutaneous tissue of the nape of the neck, back, and buttock. They occur, however, on the front of the body and the extremities, and on the lip or face. The disease is so slow in its progress as at times to occupy many weeks, one part going through its course while it spreads in another. It may destroy life by exhaustion or by pyæmia; the worst form of pyæmia arises from it; indeed, M. Labat ('Med.-Chir. Soc., Bordeaux,' 1868) believes pyæmia to be the most common cause of death in carbuncle. Rare cases have been recorded in which peritonitis was caused by the extension of the disease from the abdominal walls into the peritoneal cavity.

Situation.

Slow progress.

When the treatment by incision is adopted, life is too often shortened by loss of blood. As a general rule, however, carbuncle is not a fatal disease. Its danger depends much upon its extent, and more upon the complication with which it is associated.

Treatment of carbuncle.

Incision deprecated.

TREATMENT.—In former days the one form of local treatment that every surgeon followed was that of the crucial incision +, the knife being passed freely through the tissues to the base of the inflammatory effusion; the object of this was to give room for the slough to separate and come away. In modern times the value of this practice has been much questioned, for it was too often found to be followed by loss of blood, where blood was much needed; nor has it been thought that the incision did much to hasten the progress of the case or the separation of the slough. It is still, however, a popular form of practice. I was taught it, but after observing its effects have long given it up, believing that it did little or no good, and was often followed by a harmful hæmorrhage.

Caustics preferred.

How to use caustic potash.

The treatment I prefer, and have adopted for many years, has been that by caustic, and the more I see of it the better I like it. It has been strongly advocated in this country by Pritchard, and in America by Dr. Physic. It is applicable in the stage of the disease when the cellular tissue is brawny, and the early inflammation of the skin has subsided; it may be used before any openings in the skin are found, either as Pritchard advises, by rubbing the caustic potash freely in the centre of the carbuncle until an eschar is fully formed, or, by which is preferable, puncturing with a scalpel, and inserting the stick or a small piece the size of a pea well into the diseased tissues. When the carbuncle is large, many punctures may be made, one to every area of surface of the dimensions of half a crown. Where openings exist, the surgeon has only to insert the caustic and allow it to melt, either in the stick, or, what is better, in pea-like masses, by means of dressing forceps passing them well down into the subcutaneous tissue. By this practice the slough is certainly cast off more readily than when inci-

sions are made or the case left to nature. No bleeding takes place, and very little pain is given excepting at the time. With this treatment large carbuncles become soon healthy granulating wounds. The only care required is to prevent the caustic running over the sound skin. During this treatment a wad of absorbent cotton wool should be applied, with some lotion such as that of boracic acid, carbolic acid, or alcohol; a solution of opium applied to the part often gives relief to pain. Tonics, good living, and fresh air, are also essential. The French surgeons prefer the use of the Vienna paste. Paget prefers the common resin cerete. By these means, unless the carbuncle is associated with some serious malady, such as diabetes or pyæmia, a good result may be looked for. Caution.

The plan of making a subcutaneous incision has been ably advocated by Mr. French and M. Guérin, and that of compression by Messrs. O'Ferrall and M. H. Colles, of Dublin ('Dub. Quart. Journ.,' 1864). The former plan I have tried, but have failed to find its advantage. The latter I have not employed, having been already well satisfied with the caustic treatment. Sub-cutaneous incision. Compression.

Facial carbuncle.

This has been often miscalled "malignant pustule," to which attention has been drawn (p. 134). It was probably first described by a clever young surgeon, Harvey Ludlow ('Med. Times and Gaz.,' Sept., 1852). It is generally found on the lip, the upper one being the more commonly involved, as an œdematous inflammatory swelling of the part, involving the nose and cheek, often preceded by some pustule or vesicle, and generally accompanied by them. It is almost always associated with severe pain. It ends, as do most cases of carbuncle, with sloughing, and at times the whole substance of the lip or cheek gives way. It is associated, like carbuncle, with great constitutional depression, and its special danger is thrombosis and phlebitis of the cerebral sinuses; the inflammation of the veins extends from the affected parts through the ophthalmic veins to the cavernous sinus. I have seen six cases at least of this affection, four of the upper and two of the lower lip, and all recovered. In only one did the disease extend beyond the lip, while in all, the disease, as far as local treatment was concerned, was left to natural processes, cleanliness and fomentations being alone employed. Tonics and good diet were given, and quinine with iron, in full doses, appeared the best. Paget advises quinine in sufficient doses to produce symptoms of cinchonism. On facial carbuncle. Its special danger. Treatment.

M. Reverdin, of Geneva, gives a very elaborate essay on this subject in the 'Archives Générales de Médecine,' 1870. At p. 162 of the August number he thus sums up his conclusions: Reverdin's conclusions.

1. Anthrax and furuncle of the face present a special gravity.
2. This gravity is due to the ready complication with phlebitis.
3. The facial phlebitis is attended with death, either by extension to the sinuses of the dura mater, or by becoming the source of purulent infection.
4. Of anthrax of the face, that of the lips is more frequently complicated with phlebitis than the others. This may be explained by the peculiar texture of the lips.
5. Anthrax of the lips has nothing in common with malignant pustule.

6. The involving of the orbit in the phlebitis, as demonstrated by exophthalmia, shows almost for certain the implication of the sinus.

7. Incision, speedily and extensively performed, seems to be the best means of preventing and sometimes of arresting the phlebitic complications.

Perforating ulcer of the foot.

On perforating ulcer of foot.

This affection was so called by Vesigné of Abbeville in 1850. It is an affection which Mr. Hancock brought prominently before us in an able paper published in the 'Brit. Med. Journal,' June 26th, 1869, although Cloquet, Boyer, and Nélaton, of Paris, have also described it.

Nélaton's description.

Nélaton says it "commences with phlyctæna in the pad of the foot. The epidermis is raised by a small quantity of purulent serum. Others describe it as commencing like a flat corn, which ulcerates. When this is opened the subjacent dermis appears of a rose colour, and when touched is highly sensitive. This state may continue for some time, when the dermis in its turn gradually ulcerates, and a small fistulous opening is established in the subcutaneous cellular tissue, which will not heal, but continues to discharge serum slightly tinged with pus. If after five or six weeks the sinus is examined by a probe, the subjacent bone is felt rough and necrosed, and a sequestrum subsequently forms."

Savory, 'Med. Chir. Trans.,' vol. lxii, 1879.

An attempt has been made to connect this local affection with nerve lesion—central or peripheral—but evidence is still wanting to prove that there is more than an accidental connection between the two conditions.

Treatment.

The disease is most obstinate in its character, generally spreading over years. It is, however, chiefly local, and confined to the anterior portion of the foot. Medicine has little power over it; Fowler's solution has been much vaunted for its cure, but with insufficient evidence; and, as far as facts can guide us, it appears Hancock's conclusion, that when dead bone exists it should be removed, is the only right one. "But if, notwithstanding, the disease returns, there can no longer be a question that when once perforating ulcer of the sole of the foot is established and recognised, it is better at once to remove the whole of the metatarsal bones, either by Chopart's, Syme's or Pirogoff's amputation."

These cases are not to be confused with the suppurating bursæ or bunions found in feet deformed from short or tight boots.

Delhi or Oriental Sore.

The Delhi boil.

This disease, which is identical with the Moultan sore, Aleppo boil or Biskra bouton, "yaws of the West Indies," and Parangé of Ceylon, is a cutaneous disease, due to the entrance of a parasite into the body during bathing or washing, through an opening in the cuticle caused by an abrasion of the skin, such as a mosquito-bite. The parasite is supposed by Messrs. Alcock and Fleming, of the Indian Army ('Med. Rep.,' 1868), to dwell in the foul, brackish, hard well-water (the Delhi well-water containing 45 to 50 grains of carbonate of lime per gallon). Such good observers as Messrs. Lewis and Cunningham ('Appendix to 12th Report of Sanitary Commissioners with Government of India) assert, however, that the disease is of the nature of a lupus, and should be treated as such. Indeed, they describe it as "lupus endemicus" ('Lancet,' April 7, 1877). It may attack dogs and horses. "It appears on the exposed parts of the body, at first as a small pimple, like an itch

tated mosquito-bite, and remains in this state for several days or weeks, sometimes for months. It then slowly increases, and a thin fluid escapes from the top, which dries and forms a circular scab, gradually increasing in size and thickness. When this scab is removed an indolent ulcer is exposed, with undermined edges and lobulated granulations in the centre, in healthy subjects like raspberries, but paler and more blue in cachectic cases. These ulcers, when very broad, show signs of cicatrising from the centre; in all there remains a depressed cicatrix after healing. The disease may last from six months to two years" (Surgeon-Gen. Murray, Epidem. Society, March, 1862). It is to be treated by personal cleanliness, the avoidance of the use of foul *hard* water, the early destruction of the sore by the cautery or caustic, and the application of metallic astringents. Tonic treatment, a good diet, and if possible change of locality and climate should be secured. Treatment.

Mycetoma or the fungus disease of India.

This disease has been described by Dr. Carter, of Bombay, in the 'Trans. of the Med. and Phys. Soc.,' Bombay, 1861, and in a memoir published by Churchill, 1874, and it is supposed by him to be due to the presence of a fungus. Other authors have thrown doubt upon this point, and amongst them F. B. Lewis and D. Cunningham, of Calcutta, who conclude that it is reasonable to infer that localised spots in the tissues undergo degenerative changes into a substance peculiarly adapted to the development of filamentous growths. The origin of the fungus in situations where no spore could penetrate must remain matter of perplexity (M. J. Berkeley, 'Nature,' November 9, 1876). The disease, however, is well recognised. Berkeley observes that the bodies found in the disease "so nearly simulate fungous growths, that it is difficult to get rid of the notion that they are really vegetable growths." ('Intellect. Observ.,' 1863). The disease is more frequent in men than in women, and affects all classes, rich as well as poor, but it has never attacked a European. The fungus disease of India.

The disease is chronic, and affects most commonly the foot, sometimes the hand, and but rarely other parts of the body. It is very slow in its progress, and has no tendency to get well if left alone. Usually it begins on the plantar surface of the foot or the palmar of the hand, as an induration in or under the skin; this subsequently softens down, a bleb then forms over the spot, and bursts, leaving a sinuous opening, from which exudes a thin, sanious, sero-purulent discharge. As the disease progresses, other indurations, followed by sinuses, form, till the foot or hand becomes one indurated diseased mass, riddled with holes, the orifices of sinuses, which may or may not lead to bone; and in extreme cases the bones are tunnelled. These sinuses discharge freely a putrid sero-purulent fluid, containing "fungus particles." The fungi are of two kinds, each, according to Dr. Carter, marking a variety of the disease. One, the dark or dark brown, is globular or ovoid in form, hard and friable in consistence, and of the size varying from a pin's head to that of a bullet. The other is pale or yellowish in colour, soft and cheesy in consistence, and of the size of a minute speck or pea. Dr. Carter and others believe that excision or amputation of the affected part is the only sound practice to be adopted.

Warts.

On warts.

These are outgrowths of the papillæ of the skin, the papillæ being usually elongated and their epithelial covering thickened. They are common on the hands and other parts of the body of the young, and more rare in the adult. When on exposed parts of the body they assume a horny hardness; but when surrounded with moisture or the secretion of the skin they are soft and more sensitive.

Flat warts. Pedunculated warts.

The flat wart is called *verruca simplex*, the pedunculated *verruca digitata;* and these are said to be more common in the scalp. I have seen them on the neck, orifice of the nose, mouth, eyes, ears, and anus, also on the prepuce and labia. I have seen them also on the tongue. They occur at times beneath the nails, and are very painful—*subungual*. The worst crop of warts I ever saw was around the anus of a boy.

The flat warts occasionally come and go in a way which cannot be accounted for; as a rule they are, however, persistent. They rarely last into adult life, but when they do they seldom grow or give trouble. In exceptional cases, under some local irritation, they may increase and assume more the character of an epithelial cancer. When on the face this change is peculiarly liable to occur. Not long ago I destroyed an epithelial cancer by the ala of the nose, the size of a florin, that had suddenly appeared in a wart which had existed for sixty years, nearly all the patient's life, and I have removed from the lip of a man a cancer that had grown from a wart which had existed as long as he could remember.

Venereal warts.

Venereal warts are very abundant, whether they grow from the glans penis or prepuce of the male or labia of the female. They are pedunculated, moist, and highly vascular, and are clearly contagious. Warts, however, may occur at times in these parts without any venereal contact.

Treatment of warts.

TREATMENT.—Some powerful alkali, such as ammonia, to dissolve the cuticle, and the subsequent application of the glacial acetic acid, nitric acid, or acid nitrate of mercury, to destroy the papillæ, is the best plan to get rid of the harder or flat warts. Lunar caustic is an unsatisfactory and tedious remedy. Pedunculated *dry* warts should be cut off with the knife or scissors, and the *moist* may be treated in the same way when not too extensive. When, however, they are extensive, they may be made to dry up by the application of some powder, such as the oxide of zinc, or even starch. Powdered fresh savine is a good application. Mr. T. Smith recommends it to be mixed with the powdered diacetate of copper. The perchloride of iron in tincture is also serviceable. Venereal warts and others, when extensive, may be readily destroyed by means of the galvanic cautery, the patient being under chloroform. At times excision is the best practice. In the large masses that are found on the genital organs of women, of venereal origin, nothing but the removal of the whole with the labium can be entertained; when the écraseur of the galvanic cautery cannot be obtained, the ordinary wire instrument may be used. The hæmorrhage from these venereal warts is generally severe; and the Surgeon should never attempt to remove them by excision, when they are extensive, without having at hand some good styptic, such as the solution of the perchloride of iron, matico, alum, dry and in solution, or the cautery in one of its forms.

Moles.

On moles.

Using the word in the broad sense to include small spots of discoloured skin, and cutaneous connective-tissue tumours with pigment, with or without unnatural growth of hair or skin glands, they are very common; few people being without one or more upon the surface of the body, while many have them in numbers. I have seen a woman studded all over with hairy moles, the hairs having been in some half an inch long and bristly. Moles are generally congenital, but at times put in an appearance later in life; they are rarely of any great importance beyond the disfigurement they produce; occasionally, however, they degenerate or become the seat of a cancerous disease, the melanotic sarcoma has frequently its origin in such congenital spots. This clinical fact, which is now fairly recognised, is important, and renders it expedient for the Surgeon to excise any mole that has a tendency to grow or to become indurated in middle life. Many of the most virulent forms of multiple cancer the Surgeon sees have their origin in moles.

May be the seat of cancer.

Corns.

On corns.

These are thickened cuticle, the result of *occasional pressure*, whether on the toes or feet, from tight or hard boots; or on the hands, from the mechanical irritation of tools, &c., or elsewhere. It should be remembered that they are the result of occasional, and not constant pressure, the latter causing atrophy and absorption. Not only, wrote Hunter, "the cuticle thickens, but the parts underneath, and a sacculus (bursa) is often formed at the root of the great toe, between the cutis and ligaments of the joint, to guard the ligaments below." This bursa is found under all corns when the pressure is not removed. A corn, when newly formed, can, by maceration, be elevated from its position as thickened cuticle only, the cutis being unaffected; but in old corns the cutis appears to atrophy, and the papillæ to disappear. Such corns, writes Mr. T. Smith ('Holmes's Syst.,' vol. v), "may be found based upon the fibrous tissue of the sheaths of the extensor tendons of the toes, all intermediate structures having been absorbed." When a bursa has formed it may inflame or suppurate, and give rise to troublesome conditions, such as will be described under "bunion."

A corn is called "soft" when it forms between the toes. It is far more painful and sensitive than the "hard;" it grows also more rapidly, probably owing to its greater moisture.

Soft and hard corns.

Treatment of corns.

Treatment.—Remove the cause and the disease will disappear. This is a doctrine which applies to corns of all forms, when acted upon early. Boots which are too loose are as injurious as those which are too tight; where one presses the other rubs, the result being the same. A well-fitting boot, with a broad sole, *straight inner border*, and square top, is the best. To remove the cuticle nothing equals warm water; and after soaking the part in it for some time, or keeping the corn covered for a night or more with water dressing and oiled silk, the whole may be carefully peeled off by means of a knife. After the removal of the corn, the skin should be protected by a piece of soap-plaster spread on leather. The application of nitrate of silver has been recommended, but I have known it produce great pain, and, when applied to an inflamed corn, much harm; indeed, in one case sloughing of part of the integuments covering the little toe. In old people it is

dangerous. The application of the glacial acetic acid is to be preferred. When suppuration takes place beneath a corn it should be relieved by a puncture as soon as possible, and water-dressing applied. Bursal swellings are to be treated as bunions. Soft corns are best treated by taking away pressure by means of the introduction between the toes of absorbent cotton-wool and the use of some dry powder, such as the oxide of zinc; the corn thus soon becomes a dry one, and is easily eradicated. Acetic or carbolic acid is a good application in obstinate cases.

Bunions.

On bunions. Mode of formation.

When from excessive or long-continued pressure a bursa forms over one of the tarsal or metatarsal articulations, a "bunion" is said to be present, and the most common seat for this affection is the metatarsal joint of the great or little toe. This fact is to be explained by the

FIG. 51 A.



Bunion.

FIG. 51 B.



Toe-cap for the cure of bunion.

evil tendency which boots, as generally made, have to draw the toes together towards the central line of the foot. The central axis of the undeformed great toe which runs parallel with the metatarsal bone through the centre of the heel being thus made to deviate from the normal to an abnormal line, in which the great toe itself, looking outwards, forms with the metatarsal bone at the joint, an angle pointing inwards, and the axis of the toe falls far within the normal one of the foot (Fig. 51 A).

Key's opinion. 'Guy's Hosp. Rep.,' 1836.

Aston Key, however, attributes this deformity more to excessive weight received on a weak tarsus and metatarsus from over-standing; the great toe being gradually forced outwards by the oblique bearing of the foot on its inner plantar surface, when the arch of the foot has given and the foot become flat. Too short boots greatly favour this change, the foot by such being compressed longitudinally, and the arch of the tarsus increased; the toes even being drawn up to form angles with the metatarsal bones—the great toe suffering the most. When bursæ form over the projecting bones, it is to save the joints from injury, and at times these form over the dorsum itself. Under extreme conditions the bursa may inflame and suppurate, giving rise to obstinate and troublesome sores. In still more extreme or neglected cases the joint of the great toe may be involved, ending in its destruction with or without exfoliation of bone.

Treatment of bunion. Preventive.

TREATMENT.—When the nature of a bunion is understood, the principles of its treatment become clear. Preventive treatment is the best, and consists in maintaining the natural condition of the foot; it

young children, and in girls especially, by guarding against the flattening of the foot from over-standing or walking during the period of growth, and against altering the axis of the great toe by keeping the inner line of the boot straight; and in no way by too short boots cramping the foot longitudinally.

When a bunion has formed, the only consistent treatment is that which tends to restore the misplaced toes to their natural position; when the great toe is involved, either by Key's plan of having a separate compartment made in the boot, so constructed as to keep it in a straight line with the foot, or by the simple apparatus given in Sayre's work on orthopædic surgery (Fig. 51 B), which consists of buckskin or linen caps to the toe (*a*), a few inches of elastic webbing (*b*), a piece of adhesive plaster to go round the foot (*c*), and two circular pieces of the same (*d*) to retain all in position. Even in severe cases this practice may be successful, and in the old and confirmed cases the same is to be adopted; palliative treatment, however, is at times alone practicable. Restore natural position of the toes

The common plan, wrote Key in 1836 ('Guy's Hosp. Rep.'), resorted to for the relief of bunion palliates the evil, in some degree, by removing the pain, and taking off the pressure; but it does not go to the root of the evil. The plasters on thick soft leather are agreeable to a painful bunion by keeping the skin in a pliant state, and by protecting the part from pressure;" but they do not cure the disease.

Under all circumstances, pressure is to be removed; nothing like a tight boot ought to be thought of, a wide and easy one being worn. To the inflamed bunion water-dressing is the best application. Should suppuration take place, an early incision into the bursa should be made. In old people, however, some caution is called for in carrying out this practice, because in such, where from diseased arteries or other causes the circulation is feeble, gangrene of the part or a troublesome suppuration may arise. When suppurating sores exist, they may in the aged require stimulating applications; in the middle-aged, the bursa may be laid open and allowed to granulate, or be excised. In the early stage of a bunion the mechanical means suggested may be aided by the local application of a small blister, and Mr. Thomas Smith speaks highly of the local use of the biniodide of mercury, ten grains to an ounce of lard. ('Holmes's Syst,' vol. ii, p. 938, 3rd edition.) Removal of pressure.

In the last stage, when the joint is destroyed, the case may have to be treated by incision of the parts, excision, or even amputation.

In-grown toe-nail.

This is a troublesome and painful affection, and is more commonly met with on the outer side of the great toe-nail than on the inner, though it may occur in both places. It is usually caused by external pressure upon the soft parts, the movable soft parts being pressed upon the immovable nail. As often as not, it is due to the collection of cuticle beneath the edge of the nail, this cuticle acting as a foreign body and by its pressure causing ulceration. Ulceration having once been set up, the healing process is prevented by the presence of this cuticle, together with the pressure of the edge of the nail, and the soft parts covering it in; fungous granulations, as a consequence, frequently form, and copious discharge takes place, the affection being attended with severe pain. On in-grown toe-nail. Causes. Fungous granulations.

Other Diseases of the Nails.

Arrest of growth of nails.

Under the influence of some acute diseases, the nails cease to grow, and the arrest becomes manifest, as convalescence advances, by a transverse groove in the nail, while the width of the groove denotes the duration of the arrested growth.

Ridged nails.

As a result of hereditary syphilis Mr. Hutchinson has shown, that the nails may become completely ridged, while even in acquired syphilis, Hutchinson, Wilks, and Fagge have fairly proved that the nails may become narrow, thick, ill-formed bodies, or concave, rough, and black.

Fig. 55.



Horny growth from beneath nail.

Fig. 56.



Ungual exostosis.

Psoriasis of nails.

Psoriasis affects the nails somewhat in the same way, the nail thickening and splitting vertically, and in *favus*, Fagge has shown that the nails may become thickened and of a yellow colour from the interstitial deposit of the parasitic disease. Wilks, in the 'Lancet' for 1868 and Fagge, in 'Guy's Hosp. Rep.,' 1869-70, have written fully on these points. At times the nails become soft, and, in feeble subjects, very convex. This condition is said to be common in phthisical subjects, but in surgical disease I have often observed the same condition appear during illness, and disappear as strength returned. I regard it only as an evidence of feeble power.

Clubbed nails.

Horny growths and ungual exostosis.

Horny growths occasionally spring up beneath the nail, as seen in Fig. 55, and **ungual exostosis** very frequently appears—which is a bony outgrowth from the extreme phalanx of the great or other toe, as seen in Fig. 56. Both require excision.

ELEPHANTIASIS.

Elephantiasis Græcorum.

This term has been applied to two very different diseases, the *Elephantiasis Græcorum, or true leprosy*, and the *Elephantiasis Arabum, or Cochin or Barbadoes leg*. The former is probably constitutional, and appears as a tubercular affection of the skin, more especially of the face, attended with some loss of sensation; it is usually ushered in with slight febrile disturbance and local œdema. As it advances, the skin thickens and the tubercles multiply; the disease spreads, and involves the tongue, mouth, nose, eyes, and even larynx and lungs. In extreme cases ulceration and disease of the bones exist; the subjects of the affection dying from exhaustion, if not

from suffocation. It is, happily, rare in this country, although it does occur occasionally; it is, however, common in Norway, in the Mediterranean, and in the Indies. Dr. Webster, in the 'Med.-Chir. Trans.' for 1854, and Mr. Day, in the 'Madras Quart. Journal' for 1860, give valuable information upon the subject, and Dr. Carter, in the 'Trans. Med. and Phys. Society of Bombay,' vol. viii, new series, enters fully into its pathology.

Gurjun oil.

The disease has been regarded as incurable, although, since the introduction in 1873 of the Gurjun or wood oil by Dr. Dougall, of the Indian Medical Service, better results of its treatment have been realised. The oil is used as an external application, made into an emulsion with lime water, in the proportion of one part to three, and should be well rubbed in twice a day for two hours at a time. It has also to be taken internally in two-drachm doses mixed with the same quantity of lime water twice a day. With this treatment the tubercles are said to soften down; and in their place watery blebs form, which burst and discharge a clear serous fluid, and then the induration gradually subsides. The oil taken internally is a diuretic and purgative.

Elephas.

Elephantiasis Arabum.

To the Surgeon the second form of elephantiasis, or the *Elephantiasis Arabum*, is of the greatest interest. It is quite distinct from the true leprosy. It appears generally in one or other of the lower extremities, or in the male or female genital organs. It shows itself as a general infiltration into the skin and subcutaneous tissue of an organisable material, whereby the integument becomes hypertrophied and greatly thickened. It is commonly associated with some enlargement of the lymphatic glands, and frequently with dilatation of the lymphatics. It is occasionally associated with chyluria. In advanced disease the skin falls into great folds, and, between these, fissures form, which subsequently pass into oozing ulcers. At times the foot and leg become the seat of extensive ulceration, which rarely cicatrises.

It generally begins with some febrile attack, and the affected part becomes the seat of erythematous redness and swelling, which subside, again to recur; each attack leaves some extra thickening behind it. I have observed this very clearly in many cases, and have no doubt that the erythema had some distinct relation to the disease.

Dr. Wise, of Calcutta, in 1835, looked upon elephas as a disease of the venous system, and inflammatory. Mr. Day, in the paper already alluded to, regards it as consecutive to malarious fever, while Mr. Dalton ('Lancet,' 1846) looks upon it as a constitutional disease, like the leprosy; and upon this theory the sciatic nerve of the affected limb has been resected by Dr. J. S. Morton, of Pennsylvania, with some success. Dr. Carnochan, of New York, believes it to be associated with an enlargement of the arterial trunks of the part, and upon this theory based his practice of tying the main artery of the limb, thereby starving the disease. He performed this operation for the first time (in January, 1851), and the success he met with, as published in a memoir on the subject in 1858, induced me to follow his example in 1865. My case in all its details was published in the 'Med.-Chir. Trans.,' 1866, and the benefit of the operation was most striking. It occurred in the case of a Welsh girl, æt. 25; the disease had been of two years' stand-

Treatment.

Example.

ing, and was spreading. The thigh of the affected limb (Fig. 57) measured twenty-seven inches round, and the leg nearly twenty-three, the affected leg being nine inches in circumference larger than the sound one, and the thigh seven. Five weeks after the ligature of the external iliac artery the calf of the affected limb measured seven inches less than it did at the time of operation, and when she left the hospital the limb appeared as in Fig. 58. The rapid disappearance of the thickened tissue was very remarkable. Since the operation the girl has gone on well, is companion to a lady, and can now walk ten or twelve miles. The limb becomes slightly œdematous only on over-exertion.

Fig. 57.



Fig. 58.



Case of elephantiasis Arabum before and after the application of a ligature to the femoral artery.

I have performed the same operation three times since, but not with similar success. I ligatured the femoral artery of a man who had the whole limb involved, the thigh being only slightly so, and for a time everything promised to be as successful as in the case previously recorded; but an attack of erythema came on, followed by renewed swelling of the extremity, which never disappeared. In this case the size of the superficial femoral artery was extraordinary, the loop of the silk ligature when it came away being capable of admitting a No. 12 catheter. The vessel seemed to be nearly the diameter of my finger, and was very thick. In a more recent case, however, gangrene of the foot, followed by death, took place.

When this operation is performed the vessel should be ligatured well above the disease. I may add that Butcher in 1863 and Alcock in 1866 had successful cases; though Sir Joseph Fayrer, and Buchanan of Glasgow, have not met with successful results.

When surgical interference of this kind is not applicable, elevation of the affected limb or pressure should be employed. In severe cases amputation may be called for.

On three occasions I have had to circumcise patients with elephantoid of the penis and scrotum, and in each after the operation the whole of the thickening of the scrotum disappeared. This fact is worthy of record.

Pathology of disease.

Within recent times an opinion has gained ground that the true pathology of this elephantoid disease is to be found in the lymphatics, and that it is due to lymphatic obstruction. It has, moreover,

been thought by Dr. T. Lewis that the presence of the *Filaria sanguinis hominis* might have something to do with it, since the parasite has been found in the blood of patients who have had elephas.

In support of this view a very striking paper has recently been published by Dr. Patrick Manson in the 'China Customs Gazette, Medical Report,' for the six months ending March, 1882, an abstract of which may be read in 'Med. Times and Gazette,' Feb. 12th, 1883: Manson's views.

"In the instances," writes Manson, "in which the parent worm has been discovered she was found in lymphatic vessels on the distal side of the glands. This has been shown to be in many if not in all cases her normal habitat. Her progeny, therefore, must travel along the afferent vessels, through the glands, and so on to the thoracic duct, and thence into the blood. The long, sinuous, and powerful body of the embryo is well adapted to perform this journey. But suppose, instead of this mature embryo, an ovum is launched into the lymph-stream prematurely, and before the contained embryo has sufficiently extended its chorion, then this passive ovum must certainly be arrested at the first lymphatic gland to which it is carried by the advancing lymph-current. It measures $\frac{1}{175}'' \times \frac{1}{300}''$, whereas the outstretched embryo is only about $\frac{1}{3000}''$ in diameter. It is much too large to pass the glands; and the embryo, rolled up in its chorional envelope, cannot aid itself. It becomes, in fact, an embolus. Now, filariæ are prodigiously prolific. Myriads of young are expelled in a very short time. I have watched the process of parturition in the minute *Filaria corvi torquati*. Every few seconds a peristaltic contraction, beginning low down in the uterine horns and extending to the vagina, expels some twenty or thirty embryos. If this process of parturition occurs prematurely, or peristalsis is too vigorous, and extends to a point high up in the uterine horns, where the embryo has not yet completely stretched its chorional envelope, then ova are expelled. These, as they reach the glands, where the afferent lymphatic breaks up into fine capillary vessels, act as emboli, and plug up the lymph-channels one after another until the fluid that carries them can no longer pass. In this way the gland or glands directly connected with the lymphatic in which the aborting female is lodged are thoroughly obstructed. Anastomoses for a time will aid the passage of lymph, but the anastomosing vessels will carry the embolic ova as well as the lymph. The corresponding glands will then, in their turn, be invaded, and so on until the entire lymphatic system connected directly or indirectly with the vessel in which the parent worm is lodged becomes obstructed." The degree of embolism and location of the worm determine the site and character of the resultant disease.

ON PARASITES.

Guinea-worm.—The *Dracunculus* or *Filaria medinensis* is one of the most troublesome parasites known in Africa, Asia, India, and tropical America. In Europe it is only occasionally met with in those who have visited the above districts. Guinea-worm.

The mature worm varies in length from two to six feet. It is cylindrical in form, white in colour, has a smooth surface, is tough and elastic, its mouth appears as a circular orifice, and it has no anus. How it *enters the body is unknown, although it is* evident that it does so *from without, and probably through the skin* of some part that

has been in contact with water, inasmuch as it is more common in the feet than in other parts of the body, although the Madras water-carriers are said to have them in the back. At any rate, the worm gets into the subcutaneous areolar tissue, where it remains. Busk tells us that it does so usually for about twelve months, although it may be eighteen. When mature and the time has come for the discharge of the embryos with which it is filled, it makes its presence known by boring the skin, protruding its head under the cuticle, raising a bleb, and coming out bodily, discharging its young filariæ externally.

Fig 59.



Guinea-worm bleb just cut off. Dr. Druitt, 'Med. Times and Gaz.,' Jan 3, 1874.

Early symptoms.

The first manifestation of the disease is usually a circular bleb, as represented in Fig. 59, although it often happens that pain and stiffness of the affected part have been complained of for some time previously. The bleb contains sero-purulent fluid, and the Surgeon, in

Treatment.

order to find the worm, should cut the raised cuticle off. "There will then be seen protruding from a little hole in the centre of the denuded cutis one or more inches of the worm of the size and colour of vermicelli or of a wax match. The Surgeon now makes a small, quill-like

Druitt, 'Med. Times and Gaz,' Jan. 3rd, 1874.

roll of adhesive plaster, rolls the worm around it, and gently draws as much as will come without the risk of breaking; and this is repeated day after day, till at last the tail, which ends in a small hook, comes wriggling out, and the case is at an end." Under these circumstances a rapid cure takes place. Should the worm break, a subcutaneous abscess is almost sure to form higher up; and when this is opened a loop of the worm can most likely be got out on a probe, and so be extracted as before.

At times no bleb forms, but merely a subcutaneous abscess. In exceptional cases more than one worm may exist. Druitt quotes a case in which nineteen had been extracted.

Considerable constitutional disturbance often attends these local changes.

Sand-fleas.

Chigoe, Chigger, or Gigger, or Sand-flea.—This is found in the West Indies and in South America, but the impregnated female only infests man. It makes its way beneath the nails or between the toes by means of its long proboscis, and, having gained an entrance, rapidly increases

globular vesicle the size of a pea. Some local irritation presence. To prevent trouble, the insect should be carefully of its bed by dilating the orifice through which it entered lle, care being observed not to rupture the globular vesicle ains the ova, for if these escape into the cellular tissue the often followed by tedious suppuration and ulceration.

Hydatid.

nococcus or hydatid, the larva of the tænia echinococcus, n entozoon in the human subject, and it may exist as a micro- ject, or as a cyst of many inches in diameter. It has highly nated walls, lined with a granular layer, and it is usually the parts of the body infected by it in a distinct capsule, exudation into and the consolidation of the surrounding contains a clear, watery, non-albuminous fluid, in which at some tænia heads or scolices, the so-called echinococci, or, in found the booklets which surround the head.

datids are met with in any part of the cellular tissue of the he lungs, liver, abdominal cavity, pelvis, and even in the pecimen exists at Guy's, in which the spinal column was so I have seen them turned out of the breast, tongue, thyroid ris, vagina, uterus, thorax, and bladder, and have removed ining them from the muscles of the neck, axilla, and thigh, lso treated many in the liver.

an acephalocyst contains many secondary cysts. I removed from one occupying the pelvis, and they were of all sizes

Symptoms negative.

c. Trans.,' vol. xvii). Hydatid tumours are to be recog- egative symptoms; they appear as tense, globular, elastic n a part, and give rise only to such symptoms as are to be nechanically by their presence; when dead they give rise to

.

Treatment.

NT.—This must vary with the position, size, and growth of d tumours. When the parasite occupies some position one of the great cavities, and can be turned out of its ans of a free cut into its capsule, no better treatment is When it occupies one of the abdominal viscera or one of the ies, it should be left alone, unless from its size it interferes rtant functions or threatens life, when it should be this point will be discussed in another page.

Cysticercus cellulosæ.

cercus cellulosæ, the cystic scolex of the common tapeworm, man, and is said to be the common parasite of the "measly as a quadrangular head, short neck, and cylindrical vesicular head being surrounded with characteristic booklets, It is particularly in the muscles and intermuscular tissue, and the viscera as the former hydatid. It is known to occur brain, heart, &c., and can be treated, when interference is by an incision into the part and removal.

sis will be considered in the chapter devoted to the affections les.

SURGERY OF THE LYMPHATIC SYSTEM.

CHAPTER V.

INFLAMMATION OF THE LYMPHATICS AND THEIR GLANDS.

Wounds of the lymphatics. Lymphatic fistula.

Lymphatics may be wounded by accident or by design, and no bad result ensue. At times, however, a fistulous opening that discharges lymph may remain. The same consequence may be the result of disease. Dr. H. V. Carter, of Bombay, has recorded three such cases in the 'Med.-Chir. Trans.,' vol. xlv, and Dr. Day another in the 'Clinical Soc. Trans.,' vols. ii and xi, which through his kindness I had an opportunity of seeing. It was reported on by a committee of the society, and they confirmed the view taken of it. It was one of hypertrophy of one lower extremity of a boy, with the occasional discharge of chyle from vesicles, which were formed on varicose lymphatics. The hypertrophy had clearly an intimate connection with the distended state of the lymphatics of the limb.

An obstructed condition of the lymphatic vessels, giving rise to lymphatic œdema is now accepted as a cause of "Elephas" or Elephantiasis arabum, vide page 234.

Subcutaneous rupture of lymphatics.

Occasionally the lymphatics after inflammation appear as a hard cord beneath the skin. In a case I had under my care some years ago this cord remained hard and contracted for many weeks after all signs of inflammatory action had ceased. It occurred in a gentleman who was in the habit at night of going through some simple muscular exercises, and in doing this, the cord in the arm snapped on the inner side of the biceps. I saw him a few minutes after the accident, and felt the two ends of the cord, which were apart for about an inch. Next morning the thin skin covering the anterior surface of the forearm was elevated, loose and baggy, from the effusion of fluid beneath it. There were no signs of inflammation or pain beyond local tenderness at the point of rupture of the lymphatic cord. In four or five days the fluid was reabsorbed, and convalescence restored, the hard cord gradually disappeared, and all traces of its separation became lost. I looked upon the effused fluid as lymph that had been poured out by the divided lymph tube, and which had been taken up again. I have not seen a similar accident since.

On inflammation of the absorbents.

The absorbent glands with their ducts, are liable to inflammation ("*adenitis*" or "*angeioleucitis*"), and this action is probably the result of the absorption of some septic material. It is almost always associated with a wound, punctured or open, inflamed, suppurating, healing, or scabbing; with some point of irritation or suppuration, such as a papule or pustule; with some centre from which morbific elements may be taken up. In what is called a simple wound the inflammation

of the absorbents may be acute, but in the poisoned it is violent and diffused. The inflammation always follows the course of the absorbents, leading from the centre of absorption towards the glands, that is, towards the body, and it never spreads backwards. When it has reached the glands, the diseased action ceases to spread; that is, it expends its force upon the group of glands in which the absorbents naturally end and does not extend through another series of absorbents to a second group. The morbific material is arrested in the glands, at least, such is the usual course of the affection. When pyæmia follows or complicates the case, it may be open to question, whether the poisonous fluid circulating in the lymphatics has not been allowed to pass into the blood through its usual channels, that is, through the inflamed glands onwards, but it is at least as probable, that the same septic material that poisoned the lymphatics and set up inflammation in the tubes and glands, was taken directly into the blood through the venous channels, thus giving rise to blood poisoning.

The glands acting as barriers.

Absorbent inflammation usually manifests its presence in a definite way. Pain and tenderness in some of the glands are generally early symptoms; with them, or soon following them, will be seen a painful band of redness, leading from the wound or infecting centre towards the gland. This red line may be continuous or interrupted; it may be a thin streak or a broad stripe of redness, and in some instances it may so radiate into the surrounding tissues as to simulate erysipelas. It should be noted that the red lines follow the course of the absorbents and not of the veins. With these local symptoms there will be some febrile disturbance, and very probably the attack will have been ushered in with a rigor.

Symptoms.

Under favorable circumstances and treatment these symptoms may subside, and the red line, with the swelling of the glands and cellular tissue around the inflamed parts, together with the constitutional symptoms, will disappear.

May subside.

In less favorable examples, suppuration may take place, either as a local or diffused suppuration of the affected glands and surrounding cellular tissue, as a local abscess in the course of the lymphatics, or as a series of local abscesses. In extreme cases the suppuration may partake more of a diffused character, such as that already described as taking place in phlegmonous erysipelas.

May suppurate.

May be complicated.

With these local changes the constitutional symptoms will assume different features; the febrile disturbance will be probably great, and marked by depression; rigors may repeat themselves at regular intervals, and will generally indicate some suppurative process. When typhoid symptoms appear with rigors and sweating, the case has clearly become one of blood poisoning or septicæmia.

There are thus three different classes of cases:

The "*simple*," terminating in resolution; *the "more severe,"* ending in local glandular or lymphatic suppuration; and *"the complicated,"* marked by diffused inflammation and suppuration with general blood poisoning.

The three classes explained.

In the simple form, the poisonous element is probably of a diluted or but slightly irritating nature, and is generally some altered secretion of a simple wound due to external irritation. In the more complicated or severe forms, the poisonous element is of a more active kind, and has been either introduced *from* without in the form of a *distinct animal poison, such as is derived from* a dissection wound, or

the bite of an animal; or is generated from within, as seen in puerperal cases.

Inflammation of the absorbents, erysipelas, phlegmonous or otherwise, and septicæmia, are all closely connected.

The effects of inflammation of the absorbents.

The effects of inflammation of the absorbents, however, are not constant or alike in all cases. In some the glandular enlargement alone is to be recognised, with more or less extensive suppuration of the glands and their surrounding connective tissue, without any external evidence of inflammation of the lymphatics leading to the glands. In others the red line of inflamed absorbents will be visible without glandular complication, or little more than a slight induration of the gland. At times there will be suppuration only along the track of the lymphatics but none in the glands, this suppuration taking the form of local abscesses. I have seen in a case of absorbent inflammation of the forearm and arm, four distinct abscesses in the line of inflammation, with only axillary glandular tenderness.

Seat of absorbent inflammations.

This absorbent inflammation is most common in the extremities, though it may occur anywhere. There seems no doubt that a large number of the cases of glandular abscesses are of this nature. Pelvic abscesses in women are known to be of this kind, because pus has been found in the absorbents of the part.

Glandular suppuration in the neck is, from its position, a dangerous affection, the connective tissue of the parts being so loose, and the fascia covering them so firm, that burrowing suppuration often takes place. These deep-seated suppurations should be opened early, and as soon as any local evidence of pus exists; and in this way, viz. by cutting through the fascia with a lancet, and thrusting a director or forceps into the deep connective tissue. I have opened an abscess at the base of the tongue in this manner, from beneath the jaw, with an excellent result. The swelling affected deglutition and respiration and threatened life.

Treatment of absorbent inflammation.

Local.

Treatment.—When indications of absorbent inflammation appear, the wound or sore should be well cleansed, the scab removed, and any collection of pus let out. The affected limb should be raised, the foot, when involved, brought higher than the hip, the hand or elbow than the shoulder; and warm poppy fomentations should be applied along the whole course of the lymphatics up to the group of glands in which they terminate. Some surgeons, particularly the French, advise that the inflamed line should be pencilled with caustic, and dry warmth applied, such as cotton-wool; but I prefer the practice already indicated, as it gives more comfort. The application of the extract of belladonna and glycerine to the part is also most beneficial.

As soon as suppuration appears, the abscess must be opened, whether this follows directly upon the inflammation or subsequently. At the very earliest period of the inflammation, when the tongue is foul, an emetic has some influence in checking its progress. A good saline purge is also beneficial.

Constitutional.

Sedatives should be given to allay pain, such as small doses of morphia, three times a day, with a double dose at night, to induce sleep. When suppuration has taken place, tonics may be administered, of which iron is the best.

In chronic cases, where induration in the track of the ducts remains, mercurial ointments and friction are sometimes valuable.

lands, and particularly those in the neck, are very apt to inflame En
r fevers or the exanthemata, and to give rise to much local distress. gla
atients who are not extremely feeble these enlargements, as a rule, feve
side by themselves under careful management, though in exceptional Ope
s they suppurate. absc

ocal warmth applied by means of cotton-wool, tonics and nutritious
l, are the best remedies; but when suppuration threatens, warm
entations are more grateful to the patient. Abscesses should be
ed early. Before opening, however, it is well to try what drawing-
he pus by means of the "aspirator" may accomplish, repeating the
ation as the pus re-collects. In some instances a cure may be
cted by these means, and thus a scar is prevented. Should aspira-
fail, an incision ought to be made.

he local application of iodine under these circumstances, although
mmon remedy, does not appear to be of much value.

hronic glandular enlargement is a very common affection. It is Chronic
d in the strumous and feeble child, as a chronic and slightly glandular
iful enlargement of a gland or glands, more particularly those enlargeme
eath the jaw and about the neck, and comes on either after ex-
ire to cold, some slight illness or local irritation, such as bad teeth,
ithout any definite cause. It often subsides spontaneously on the
oval of the cause or on the improvement of the general health. At
s these glands suppurate and leave ugly sores, the cellular tissue
nd the gland becoming destroyed and the skin consequently
ermined. The pus from these glandular enlargements is sometimes
ormed and curdy; and when it attends the breaking down of some
disease it may contain a chalky deposit, the produce of some
nerated or dried-up tuberculous or other matter.

odgkin's disease of the glands or general lymphadenoma.

ere is, however, another chronic enlargement of the glands that Hodgkin's
rs to differ in all ways from the local enlargements to which disease of th
tion has just been drawn. It was first described by Dr. Hodgkin glands.
e 'Med.-Chir. Trans.,' vol. xvii, and may be called Hodgkin's
e of the glands, or, for the sake of distinction, glandular tumours.
served it first in the mesenteric glands, though any or all may be
d. In it the glands become very much enlarged, even to the
an egg, and apparently more numerous; they present a smooth
l appearance, and have a soft semi-fluctuating elastic feel. On
the surface of the gland presents a smooth, bloodless semi-
rent, loose, succulent structure; microscopically it is made up
dular tissue and abundance of fibro-nucleated tissue; it is of a
eathery consistence, and exudes a clear serous fluid. The
are always free, each being separable from the others.

e Surgeon, the disease, at times, appears as a local movable Characters.
r tumour of a slow painless growth, which medicine has
o power of influencing; it has the local clinical appearance
gn fibro-cellular tumour, and has often been excised as

r instances the tumours are multiple, three, four, or many
ing in one locality, chiefly in the neck. In exceptional
e tumours are more numerous. I have seen cases in which,
of the neck, the subcutaneous tissue seemed filled with
ular tumours, readily movable one upon the other, as if

simply confined by skin, in the same way as the adenoid tumours of the breast are occasionally met with. In still rarer examples the whole glandular system seems to be affected, every group of glands not only being apparently enlarged in size, but also increased in number.

This disease is often associated with an enlarged spleen, and appears pathologically to be allied to that blood disease now known as leucocythæmia, notwithstanding that in many instances the white corpuscles are not in excess.

On one occasion I had an opportunity of watching the gradual development of this affection. It began in the cervical glands, and gradually involved the whole glandular system, the patient, a boy, at the age of fifteen, dying with an enormous spleen and glandular tumours in every region. His blood was made up almost entirely of white blood-corpuscles, death resulting from exhaustion.

Another case I treated five years ago, a woman, æt. 56, has lately returned convalescent from lymphadenoma, but affected with an acute cancer of her breast.

Treatment of enlarged glands.

TREATMENT.—For the ordinary or strumous enlargement of the glands in children there is no drug equal to cod-liver oil; the syrup of the phosphate or of the iodide of iron, or, the tincture of quinine being capital additional remedies.

I have not much faith in the local application of iodine in the form of the tincture; as after the second application the skin ceases to be an absorbing surface, and the iodine becomes, therefore, a mere irritant. For some years I have been accustomed to order the solid iodine to be placed in a perforated wooden box, and on a shelf in the sitting and bedrooms; the iodine in this way evaporating gradually and iodising the air. In all glandular, as in thyroid enlargements, this mode of employing the drug seems to be of considerable value.

The iodide of ammonium as an ointment is a useful application when rubbed in, the iodide by this process becoming absorbed.

Good food and fresh air are also essential points in the treatment of these cases.

Treatment in Hodgkin's disease.

In Hodgkin's glandular tumours, iron in full doses as well as cod-liver oil seem to be the best remedies; that is, patients who can take them appear to improve in their general health, while the disease does not progress so rapidly under their use as without it; but, upon the ultimate issue, no remedy seems to have any decided influence. The late Mr. Bradley advocated strongly the administration of phosphorus in doses of $\frac{1}{50}$th to $\frac{1}{75}$th of a grain twice a day. Indeed I am disposed to think that where the enlarged glands can be removed they should be, for I am sure that I have seen life prolonged by such an operation, if not a cure of the disease brought about. When, however, the spleen or liver is involved no operation is justifiable. When isolated glandular tumours exist they may be dealt with as local tumours and removed.

In all glandular enlargements, however, the local cause of irritation should be looked for, with a view to its removal; for practically it is well to regard all glandular enlargements as due to a chronic source of irritation, in the same way as acute adenitis is known to be a result of inflammation of the lymphatics.

Disease of the glands, as connected with cancer and syphilis, is referred to in the chapters devoted to these subjects.

DISEASES OF THE THYROID GLAND.

The thyroid is a lobulated, encapsuled, ductless gland, with a cellular tructure, the cells of which contain a glairy fluid. It is highly vascu- ar, and has as large a vascular supply as any gland in the body: it is upposed to have some connection with blood formation. It is also reely supplied with lymphatics. The entire gland may be congeni- ally absent. When it is simply enlarged it is said to be hypertrophied, r the seat of *goitre* or *bronchocele—simple adenoid enlargement*— nd it is well known that these goitres attain a large size. Sometimes hey are apparently composed of simple increase of tissue, the enlarged land having much the same appearance on section as the small and ealthy one; at other times the structure of the tumour is coarser, nore cellular, or cystic—*cystic bronchocele*—the cysts occasionally ssuming large dimensions; while in a third the gland is more solid nd fibrous, or more or less mixed with cysts—*fibrous bronchocele*. The thyroid gland may inflame, as well as suppurate, and may be the eat of distinct adenoid tumours, or of cancer. Hydatid cysts have also een enucleated from its body (*vide* Prep., Guy's Hosp. Mus. 1711[60]).

General remarks.

Varieties of its diseases.

Goitre, or Derbyshire neck, as it is generally known in this country, is ery common. In its most usual form it appears as a simple bronchocele r hypertrophy of the thyroid gland, and gives rise to symptoms which re mainly attributable to the size of the tumour. At times, however, mall tumours cause symptoms, such as dyspnœa, or the cough as of a roken-winded horse on exertion, and even difficulty in breathing on he slightest cause. At other times they mechanically press upon the rge vessels and respiratory tract, producing headache and a feeling stooping or coughing of fulness in the head, with evident respiratory struction, and even difficulty in deglutition. These symptoms may appear for a time and then disappear, leaving the patient comfort- e in all respects during the intervals. In other cases, goitres which ear to be of the simple kind begin to pulsate under excitement, or r unknown cause, and are attended with some protrusion of the alls. These symptoms disappear with rest and time, and the case equently re-assumes the clinical features of a simple goitre. *All tumours rise and fall with the larynx in deglutition.*

Goitre.

Characters and symptoms.

They press on trachea and large vessels.

May pulsate.

May be attended with protruded eyeballs.

ch cases as these stand as a kind of link between the simple hat known as the *exophthalmic* goitre, Graves's or Basedow's e; and yet, between these two affections there must be some wide nce, for the simple goitre appears to be a local affection, whereas ophthalmic form is probably part of a more general disease, l by the enlargement of the thyroid body, often by prominence eyeballs, always by palpitation of the heart, a peculiar thrill in od-vessels, and a general want of muscular and brain power). "Their is no known post-mortem condition of the thyroid roper to this disease" (Wilks and Moxon). Modern notions indicate that this form of goitre is a neurosis of the cervical etic. "The numerous functional disorders which occur in disease are either due to temporary congestion of the sym- nerve, or a permanent structural alteration of the ganglionic ystem." (Trousseau's 'Clin. Med.') This view, however, of the s not yet proved, and the whole subject requires investigation.

Exophthalmic goitre.

tice of converting the cystic disease of the thyroid into a chronic abscess by the following means:—"First empty the cyst. When practicable, it is well to make the puncture as near as possible to the median line, and to select the most dependent portion of the tumour for the introduction of the instrument. As soon as the trocar is felt to pierce the cyst-wall it should be withdrawn, and the canula passed further in by means of a blunt-pointed key. The fluid having been withdrawn through the canula, a solution of the perchloride of iron (two drachms of the salt to an ounce of water) is injected through the canula by means of a syringe. The plug is re-inserted, and the canula secured in position by a strip of plaster. The injection of iron is repeated at intervals of two or three days, until suppuration is established. When this point is reached the tube is withdrawn, poultices are applied, and the case treated as a chronic abscess. Where the tumour consists of more than one cyst, it may be necessary to make a second or a third puncture; but it frequently happens that other cysts can be opened through the cyst originally punctured." Some cysts become calcareous, and should be treated by excision. The practice is only, however, to be entertained when the cyst causes symptoms which threaten life. In Guy's Hosp. Museum there is a preparation of a calcareous cyst with an intra-cystic growth.

Cysts may become calcareous.

Inflammation of thyroid.

Acute hypertrophy of thyroid.

Acute inflammation of the thyroid gland is doubtless a rare affection. I have never seen such a case. Holmes Coote records one in 'Holmes's System.' Suppuration of a cyst in the gland after surgical interference is more common.

Example.

Acute hypertrophy may appear and produce dangerous, if not fatal symptoms. Sir Risdon Bennett, in his interesting 'Lumleian Lectures for 1871,' has recorded such an instance, which I had the advantage of seeing, in consultation with him and Mr. Jackson, of Highbury. It was in a young man, æt. 19, who, three months before, became the subject of paroxysmal attacks of asthmatic dyspnœa, associated at times with a wheezing or whistling respiration, and some general enlargement of the base of the neck. Three days before his death this difficulty became extreme, the paroxysms became more frequent and severe, and on the day of his death a severe paroxysm took place, which passed on to a forced and heaving respiration, beyond anything I had ever before witnessed, and speedy death resulted. I performed tracheotomy upon the patient, with the slender hope that some light might be thrown upon the nature of the case to guide us in its treatment, if not to give relief, but in doing so, what was probable before became evident then, viz. that the obstruction was below. I had no perforated instrument with me long enough to force beyond the point of obstruction except a female catheter, which struck against some solid body that prevented its progress. After death the thyroid body was found to be much enlarged, and mainly below the sternum and along the sides of the trachea. The trachea below my opening was flattened laterally to within half an inch of the bifurcation; and was also twisted to the left, being surrounded by the greatly enlarged and firm lateral lobe of the thyroid. The structure of this enlarged gland was clearly that of hypertrophy, not of cystic or other apparent disease. As an example of acute rapid hypertrophy of the thyroid, the case, says Bennett, "points to the propriety of regarding any acute enlargement of this gland in young people with more anxiety than we are perhaps

Required tracheotomy.

accustomed to do," particularly, it should be added, when the lobes of the gland pass down behind the sternum.

Thyroidal tumours, doubtless, exist, although they are not common; these may be *adenoid* and innocent, or *cancerous* growths. Thyroidal tumours.

An adenoid growth may appear as a tumour within the gland itself, or connected with it, or more commonly as an intra-cystic growth, similar to that seen so frequently in the breast. In their clinical history such cases cannot well be diagnosed from the ordinary goitre, although, when the disease is unilateral, and assumes a rounded or irregular form, and appears to be an isolated outgrowth of the gland itself, the nature of the tumour may be suspected; when placed, however, within the gland itself, or within a cyst in the gland, the diagnosis is impossible. In the figure below (Fig. 61), taken from a drawing by Characters.

Fig. 61.



Pedunculated thyroidal tumour.

Fig. 62.



Microscopical appearance of thyroid glands. (From Dr. Moxon's drawing.)

Dr. Moxon, of an old preparation in the Guy's Hospital Museum (1711[45]), a tumour the size of a grape is depicted hanging down loosely by a pedicle attached to a lobe of the gland. In the gland there is a well-marked, cup-like depression, from which the tumour had fallen out, the pedicle mainly consisting of a large artery emerging from the gland. The growth had an ossified capsule, and was composed of a structure like that of thyroid tissue (Fig. 62). My late colleague, Mr. Poland, has recorded a like case in which excision was successfully performed ('Guy's Hosp. Rep.,' 1871). Frerichs, Rokitansky, and Virchow record somewhat similar instances. Paget thus refers to the subject of accessory thyroid tumours: "These growths of new gland tissue may appear not only in the substance of the enlarging thyroid, but external to and detached from the gland. Such outlying masses of thyroid gland are not rare near bronchoceles, lying by them like the little spleens one sees near the larger mass. Their history is merged in that of bronchoceles (see 'Virchow,' lect. 22), with which they are usually associated, whether embedded as distinct masses in the enlarged gland, or lying close to it, but discontinuous." Paget on thyroidal tumours.

Cancerous growths appear as infiltrating affections of the gland, or, as distinct tumours; they have no special clinical characters until Cancer of thyroid.

they attack the surrounding tissues by continuity, or break down. In a case of my own the disease perforated the trachea. The Guy's Hosp. Mus. contains four preparations of this disease.

Operative Interference in Thyroidal Tumours.

On removal of thyroidal tumours.

Many operative proceedings have been suggested and adopted for goitre and thyroidal tumours. Sir W. Blizard, Earle, and Coates ('Med.-Chir. Trans.,' vol. x) tied the superior thyroid arteries, with the view of starving the disease, and Coates's attempt was attended with success, but the operation is necessarily a severe one, and the free arterial supply from the inferior thyroid arteries tends to neutralise its good. At the present day it is properly discarded. Setons have likewise been used with good success, and deserve a more extended trial. Injections of the tincture of iodine or of iron have been of proved value.

Ligature of thyroid arteries.

Setons.

Removal of the isthmus is an operation which commends itself to our attention, since it is said to have been of use in the hands of continental surgeons, and Mr. Sydney Jones related at the Clinical Society on May 25th, 1883, a case in which a complete cure followed the measure in a boy with a large goitre attended with dangerous symptoms. The isthmus was excised after having been ligatured on both sides, and after the operation the lateral lobes withered.

Excision is an operation worthy of consideration when life is jeopardised from the growth, and less severe measures have failed or are inapplicable. That it can be done successfully has been proved by Reverdin, of Geneva; P. H. Watson, of Edinburgh, and Dr. W. Warren Greene, of Maine.

Dangers of the operation.

Hæmorrhage is the chief danger to be dreaded in the operation, but if the fingers be well used to enucleate the growth, without dividing or cutting into its capsule, and if the pedicle containing the vessels which supply it be rapidly reached and ligatured, bleeding may be disregarded. As an extra point of caution it appears to be a sound practice to ligature before cutting all parts that require division in the same way as the Surgeon does in ovarian cases, and for the same reason. Should the tumour turn out to be an adenoid growth, in, or connected with the gland, as in Poland's case, it may be removed with comparative facility, and should it be an enlarged gland simply, even a pound and a half in weight, success may follow, as was proved by Greene's and Watson's cases. Indeed, I cannot do better than give the several steps of the operation in Dr. Greene's own words:

Steps in the operation of removal of thyroid tumours.

"1st. Exposure of the tumour by linear incision of ample length, avoiding most sedulously any wounding of the tumour or its fascia propria.

2nd. Division of the fascia propria upon the director.

3rd. The reflexion and the enucleation of the tumour with the fingers and handle of the scalpel, paying no attention to hæmorrhage however profuse, but going on as rapidly as possible to the base of the gland, and compressing the thyroid arteries.

4th. Transfixion of the pedicle, from below upwards, with a blunt curved needle, armed with a double ligature, and tying each half, or, when practicable, dividing the pedicle into as many portions as there are main arterial trunks, and tying each portion separately.

5th. Excision of the gland, and subsequent dressing of the wound, as in ordinary cases."

Dr. P. Heron Watson, in an interesting paper on the operation

'Edin. Med. Journ.,' Sept., 1873), strongly advises that "the investing ascial sheath of the thyroid should be left undivided until the mediate igature of the vessels included in their fine cellular sheath has been ffected," and he proved by cases that this can readily be effected hrough the wound made for the removal of the gland. He condemns nything like roughness in the removal of the gland, and believes that he operation he advocates and had successfully performed in five ases, is easy, rapid in execution, and devoid of risk.

I cannot forbear, however, from quoting Dr. Greene's concluding emarks, which are so full of sound sense and wisdom. "I cannot efrain from one word of warning to my younger brethren, whose mbition may make their fingers tingle, lest they should, in the light f these successful cases, be too easily tempted to interfere with these rowths. It is, and always will be, exceedingly rare that any such nterference is warrantable, *never* for relief of deformity or discomfort nerely; only to save life, and if it is, beyond all question, determined n any given case that such an operation gives the only chance for natching a fellow-being from an untimely grave, be it remembered hat accurate anatomical knowledge, and a perfect self-control under he most trying ordeals through which a Surgeon can pass, are indis-ensable to its best performance." Greene's remarks.

SURGERY OF THE NERVOUS SYSTEM.

INJURIES OF THE HEAD.

CHAPTER VI.

CONTUSIONS AND WOUNDS OF THE SCALP.—BLOOD TUMOURS.—OSTITIS.

Injuries of the head should always be estimated *primarily* with refer-ence to the amount of injury the cranial contents have sustained; and *condarily* with reference to the risk of their becoming involved. Preliminary remarks.

However trivial an injury of the head may appear to be, it is never be lightly regarded, since what may seem a simple cutaneous bruise e result of a blow upon the head unaccompanied by any symptoms of ain disturbance, may be followed by an acute inflammation of the ploë of the skull—a condition fraught with great danger—or a ronic inflammation of the bone, which is scarcely less serious; and hen, as a primary effect of injury, there is evidence of brain concus-on, which, as a rule, means brain bruising, the risks of secondary emorrhage or intracranial inflammation are not slight. The latter mplication follows the slighter as well as the graver injuries. It is ell for the student to have these truths impressed on his mind at e beginning of a chapter on injuries of the skull, for they have a actical bearing of wide importance.

Contusions of the Scalp and Blood Tumours.

The integuments of the scalp have this peculiarity, that they are intimately connected with the aponeurosis of the occipito-frontalis muscle; indeed, practically, these parts may be regarded as one, for they are not to be separated, and move together over the cranium. They are well supplied with vessels, and, consequently, have considerable power of repair; they rarely slough. When any great effusion of blood complicates a contusion, a *blood tumour* is said to exist, and when this occurs on the scalp the affection is known by the term *cephal-hæmatoma*. In newly born children this affection is frequently met with, and it is commonly, although not always, a result of a difficult or instrumental labour. It is usually situated over the parietal bone, showing itself as a more or less circumscribed, soft, fluctuating tumour; but the largest I have ever seen was over the occipital bone. When the tumour is small and confined to one bone, the blood is probably effused beneath the pericranium (*subpericranial form*). When the swelling is larger and spread over more than one bone, the effusion, doubtless, is poured out beneath the aponeurosis of the scalp (*subaponeurotic form*).

Blood tumours of the scalp in newly born children.

In the subpericranial form the indurated base may organise, or inflammatory matter may be poured out around it, and assume the character of bone; whilst in neglected cases, suppuration may follow, which occasionally passes on to involve the bone itself.

In the subaponeurotic form the blood is generally rapidly absorbed, and during the process a peculiar characteristic crackling sensation will be often given to the hand in manipulation. In feeble infants this process of absorption may be delayed, or may fail altogether; under which circumstances surgical aid is called for.

Blood effusions later in life.

In the adult, in addition to the forms of blood tumour just described as a consequence of injury, blood may be effused into the skin itself, and appear as a hard unyielding lump.

When a blood tumour has an indurated base, rising from, and apparently continuous with, the bone, with a defined edge towards the centre, the idea may present itself that a fracture with depression exists. Under such circumstances the Surgeon will be assisted in his diagnosis by firmly pressing his thumb or finger for a few seconds upon the ridge: this act in a recent case, by displacing the fibrin, reveals the uninterrupted continuity of the bony surface, and thus proves the nature of the case; more particularly when there is an absence of symptoms of fracture. When the case is complicated with brain symptoms or a ruptured artery, giving rise to pulsation in the tumour, some difficulty in diagnosis may be experienced.

Treatment. Simple contusion.

TREATMENT.—A *simple contusion* of the scalp, uncomplicated with any great effusion of blood or other local injury, requires little surgical attention; it has a tendency to recover like contusions of other parts. Its best application is a cold or spirit lotion; muriate of ammonia, in solution, being as good as any. When a blood tumour exists, which feels tense or pulsates, broken ice in a bag, or one of Leiter's coils (Fig. 8¼, p. 48)), should be applied, the cold checking the further flow of blood and encouraging absorption. When the rupture of a large artery, such as the temporal or occipital, is suspected, as indicated by the pulsation of the tumour or other significant symptom, it may be advisable

to apply pressure over the trunk of the vessel. When absorption of the effused blood does not take place, the cystic swelling should be aspirated, and pressure applied, sponge pressure being the best; and this operation may be repeated several times. Should tapping fail, an incision ought to be made sufficient to allow of the free escape of the pent-up fluid and to prevent its re-collection; gentle pressure should subsequently be applied on the part. In very obstinate cases the tumour may be treated as a serous cyst, and injected with iodine. When the effused blood breaks up, and causes suppuration—a somewhat rare result—a free incision with drainage is required and the case must be treated as one of abscess. During this period, tonic treatment is often required to improve the patient's powers. When the tumour is large, the patient should be kept quite free from excitement, and the diet carefully regulated according to the special wants of the case. As a rule, all such cases do well.

Pressure.

Tapping.

Tonics.

Scalp Wounds.

Wounds of the scalp are very common, and large portions of the scalp may be torn away from its connections with the pericranium or bone, and on readjustment live, though much bruised and injured, the extreme vascularity of the scalp favouring its repair. Such injuries when not complicated with injury to the skull or its contents, generally do well. Blunt instruments, forcibly applied, produce scalp wounds very like those caused by sharp-cutting ones. Wounds which exhibit entire hair bulbs projecting from the surface of their sections have been probably produced by a blunt instrument, while on the other hand, when the hair bulbs are found cut, the wound has to a certainty been caused by a sharp one.

Incised and lacerated wounds.

Vide paper, 'Glasgow Med. Journ.,' Jan., 1876, by Dr. Wm. MacEwen.

It is generally thought that scalp wounds are especially "liable to prove the exciting cause of erysipelas." I doubt the accuracy of such an assertion, because from my notes of 175 cases of scalp wounds admitted consecutively into Guy's in eight years—and it must be added that only the severe are admitted—I find that erysipelas followed only in three, or in 1·71 per cent., this proportion being about the same as that obtaining in surgical cases generally.

Erysipelas after scalp wounds.

Lacerated or contused wounds of the scalp rarely slough, and should be treated as the incised. Punctured wounds are, however, liable to be followed by diffused inflammation beneath the scalp.

Punctured wounds.

Treatment. — Under all circumstances and conditions, scalp wounds should be gently and carefully cleaned with tepid water, and their edges adjusted and maintained in position; and to aid this the hair should be removed in the neighbourhood of the wound. When the wound is not extensive, and its edges can be adjusted by plaster, sutures are not needed; but when any difficulty is experienced they may be as fearlessly applied to the scalp as to other parts. In extensive lacerations, indeed, the application of sutures is decidedly preferable to any other form of practice, inasmuch as with their use the wound can be kept clean and moist by dressings, which is not possible where a quantity of strapping has been employed. In the application of the suture, however, care must be taken *not* to include the aponeurosis of the occipito-frontalis muscle, for there is more danger of setting up mischief in the cellular tissue beneath this tendon, when this practice is adopted, than when the sutures simply pass

Sutures.

Mode of application of sutures.

through the skin itself. The kind of suture is unimportant, although many surgeons prefer the metallic. All sutures should be removed on the second day, as wounds of the scalp heal rapidly. The head in all these cases should be kept cool.

Their removal.

When the pericranium is torn off and the bone exposed, no difference in practice is needed, the prospects of a satisfactory recovery under these circumstances being as good as in a less complicated case. When the bone, however, has been much injured, superficial necrosis may follow.

Diffused suppuration beneath aponeurosis.

Should exudative or inflammatory fluid collect beneath the flaps the sooner a free escape is given to it the better, since by its retention suppuration, which is always associated with great danger to the periosteum, to the bone, and even to the life of the patient, is encouraged. To attain this end the edges of the wound should be separated in parts by means of a probe, or *limited* incisions should be made through the tissues down to the bone. By adopting this practice early the inflammation will often be prevented or checked, and the extent of mischief limited.

Treatment.

When diffused suppuration has taken place beneath the scalp the pus should be evacuated by incisions well placed for drainage; the action of the occipito-frontalis muscle controlled by the pressure of a circular elastic bandage or strapping, and the surfaces of the suppurating cavity kept in apposition by sponge pressure.

To the wounds absorbent antiseptic dressings should be applied.

Prognosis.

When extensive sloughing takes place, there is no reason why a good recovery should not follow, if the powers of a patient be good and his kidneys sound.

Constitutional treatment.

The powers of a patient must be kept up by tonic medicines, such as iron or quinine, generous diet allowed, and stimulants employed when needed. Sedatives to procure sleep are also essential.

Hæmorrhage and its treatment.

When bleeding is troublesome the arteries should be twisted, acupressed, or ligatured; when it occurs merely as a general oozing of blood, pressure may be applied either to the wound or to the trunks of the supplying vessels. In rare cases, where the deep vessels of the temporal fossa are wounded and bleeding cannot be arrested, the question of applying a ligature to the external or common carotid may have to be entertained. It has never fallen to my lot, however, to witness such a case.

Contusion of the Bones of the Skull.

Contusion of bone.

This is, doubtless, a common consequence of scalp injuries both with and without a wound; as is a scratching or abrasion of the bones; and yet in the majority of such cases a good recovery takes place. In exceptional cases, however, a different result is met with, in the shape of either an acute inflammation of the bone with all its dangers, or a chronic inflammation with all its difficulties.

Acute and chronic inflammation of bone the results of contusion.

Acute inflammation of the bone is a severe affection, more particularly when the diploë is involved; for the diseased action may extend inwards, and give rise to a local suppuration between the bone and the dura mater, or between the layers of the arachnoid, running on to a diffused inflammation of this membrane and of the brain itself.

A chronic inflammation of the bone may be followed by very similar results, or, by a thickening of the injured bone.

When necrosis of the skull is present these results are always liable to occur, and with it a low kind of phlebitis of the cerebral sinuses, and pyæmia are prone to follow.

The symptoms which indicate either of these two conditions appear at variable periods after the accident, and vary in intensity according to the action. In *acute* cases the symptoms may show themselves within a few days with severe constitutional irritation and headache, passing on to general brain disturbance, convulsions, paralysis, coma, and death. In *chronic* disease the symptoms may not appear for weeks or months, and they will be less severe, but persistent headache is always present. When the inflammation spreads inwards towards the arachnoid and brain, other symptoms show themselves, such as severe local pains, delirium, twitching of the muscles, convulsions, paralysis, coma, and death; the rapidity of the progress of the disease governing the symptoms. When marked rigors appear, suppuration is indicated, often of the pyæmic kind; and convulsions of an epileptic nature are frequently found in the chronic form of the disease. *Persistent headache* after an injury to the head is always a symptom demanding anxious attention, as it too often means progressive mischief within the skull. This subject will, however, receive further elucidation in the chapter on "Intra-cranial inflammation." Symptoms. Persistent headache.

INJURIES OF THE CRANIUM.

There are some leading practical facts or principles which should be impressed upon the memory of every Surgeon who has to deal with injuries to the head. These I have formulated as follows, believing it to be well to place them at the beginning of a chapter on such injuries.

1. A concussed should be regarded clinically as a bruised brain.

2. Fractures or injuries of the skull are of importance so far as they are associated with damage to the skull contents; a compound fracture uncomplicated with shaking of, or injury to, the cranial contents, being less liable to be followed by bad results, than a simple fracture associated with brain mischief. General propositions.

3. The amount of injury to the brain cannot be estimated by the severity of the primary symptoms; a severe injury to the brain being frequently associated at first with mild, and a slight injury with severe symptoms.

4. A general shaking (concussion) of the brain, whether associated or not with simple or compound fracture, may give rise either to temporary suspension of brain functions, ending in recovery; to laceration of the membranes; to a more or less severe bruising of the cortical structure of the brain; or to laceration of its deeper substance. The amount of hæmorrhage which complicates the case depends upon the size, number, and healthiness of the ruptured vessels. Thus a general shaking or concussion in a healthy brain may only produce a temporary suspension of cerebral functions, when the same injury in an unhealthy or aged one, in which diseased vessels ramify, may be followed by a fatal hæmorrhage or apoplexy.

5. Under certain conditions of the system, and particularly where the kidneys are diseased, a slight concussion will be followed by a fatal secondary inflammation of the brain-coverings; while under other conditions a severe injury to the brain will be followed by no such result.

6. Intracranial inflammation is as prone to follow the milder as the graver cerebral injuries.

7. The character of the accident and the mode of its production furnish the best means for estimating the nature and severity of the injury, and its probable results; since a fall upon the head from a height or a blow from a heavy weight causes a *general* injury of the brain; and a fall upon or a blow from a sharp instrument a *local* one.

With these general propositions, which the student should learn and think over as a guide, I now proceed to consider the subject of fractures of the skull.

FRACTURES OF THE SKULL.

Varieties.

These may be divided into fractures of the "*vault*" and fractures of the "*base*," a third and large division including those of the "*vault and base*." They may likewise be "*simple*" or "*compound*," "*comminuted*," "*depressed*," or "*undepressed*."

Fractures of the vault are generally caused by direct blows upon the part, or falls upon sharp bodies. They include most of the *punctured* fractures and *incised* wounds of the bone, as in sword wounds, &c. They are of necessity compound and often comminuted, and the brain injury which is associated with them is for the most part local.

When not punctured the fracture may appear as a simple fissure, the extent of which is determined by the amount and character of the force

Fig. 63. Fig. 64.



Gutter- and saucer-shaped fractures of the skull.

employed, the line of fracture being influenced by the sutures and ridges of bone. When the force is local and moderate the fracture may be limited; when concentrated and severe, the fracture will be "starred" and generally "comminuted," the fissures radiating in all directions, involving many bones, and passing downwards towards the base. When inflicted with a blunt-edged instrument the fracture will be depressed in a gutter shape (Fig. 63); when with a round one, as a hammer, the bone will be depressed more like a "saucer" (Fig. 64).

Starred and comminuted.

Comminuted fractures are generally the result of a concentrated local violence, and are consequently found chiefly in the vault, and are mostly compound (Fig. 65).

Depression.

In some cases of fracture of the vault, the bone will be depressed or driven in upon the cranial contents; in sabre wounds it may be elevated, ploughed up, or displaced outwards.

The fracture will be confined in some cases to the outer table of the skull, in rarer instances to the inner; a fracture with depression of the inner table, occasionally, existing without any fracture of the outer.

When the force acts from *without* and is *great*, the whole thickness of bone may be broken, the inner table probably giving way first and being fractured to a greater extent than the outer; but when the force is *slight* the inner table may be alone fissured, loosened, or driven in.

When the force acts from *within*, upon the inner table first, the reverse of the above holds good, the outer table giving way before the inner, and being fractured to a greater extent. In Prep. 1082[70], in Guy's Museum this not sufficiently recognised fact is well demonstrated. In it, the force having been applied by a pistol bullet which was sent by a suicide through his brain, the point of impact on the inner table is represented by a black mark, whilst the outer table is starred, and in Prep. 1083[75], taken from a boy æt. 12, fracture of the outer and inner tables exist, but not in corresponding parts.

FIG. 65.



Comminuted fracture of skull with depression of inner table from direct local violence. (Prep. Guy's Mus.)

An interesting paper on this subject will be found in the 'American Journ. of Med. Science,' April, 1882, by Mr. J. Lidell.

Rule in practice.

As points of practice, however, it is well to remember that, in all ordinary cases of fracture, with depression of the bones of the skull, the injury to the inner table is far greater than to the outer, and the point of exit of any foreign body through the skull is always larger than that of entrance.

Depression without fracture.

Whether depression of the bones of the skull of an adult ever occurs without a fracture, is an open question. There is certainly no good evidence in support of the fact. In children it has happened without giving rise to any symptoms of brain compression; yet even here, says P. Hewett, "some of the bony fibres must have given way." In these cases, the depressed bone may subsequently rise up again to its natural level.

Brain complications.

The practical interest, however, attached to all these varieties of fracture is concentrated in the question as to how far the cranial contents are involved in the injury. Has the brain been slightly concussed, or so shaken as to have been bruised or lacerated? Have the membranes of the brain been torn, lacerated, or injured? Is the fractured bone a source of irritation to the dura mater? Is there a loose fragment of the inner table of bone acting as an irritant? A compound fracture with or without depression, not complicated with brain disturbance or brain injury, is a cause of far less anxiety than a simple fracture in which severe brain concussion has taken place, and is indicated by symptoms; a severe shaking of the brain, whether complicated or not with a fracture, is a far more serious accident than any local injury to the skull alone.

Fractured base, &c.

Fractures of the base of the skull, or vault and base combined—for these conditions ought to be considered together—are invariably severe injuries. They are generally, except when produced by a crushing of

the head, caused by a diffused force, such as that occasioned by a fall from a height upon the vertex, or by a heavy blow. "When the former the plunge of the body is suddenly arrested by the vertex coming in contact with the ground, and the entire superincumbent weight, with the superadded momentum acquired by the velocity of the fall, is concentrated around the condyles of the occipital bone, and the central compartment of the base of the skull is thus broken across." (Fig. 66.) The fracture is the result of direct violence, and not of so-called contre-coup.

The result of direct violence.

Le Gros Clark's explanation.

"Thus, if the injury be inflicted by the fall of a *hard* and heavy body on the vertex, this part would be fractured; and if the weight were not very great, the mischief might end there, as the resistance offered by the head may so far exhaust the momentum of the falling body that the force would not be transmitted in sufficient amount to cause fracture of the base. But if the weight and momentum of the falling body

FIG. 66.



Fracture of base of skull from fall on vertex.

were in excess of the expenditure of force in causing fracture of the vertex, the impulse would drive the head down upon the summit of the spinal column, and fracture of the base would result; in that case, viewed mechanically, the lower fracture would be successive to the upper. But if the falling weight which struck the vertex were of a yielding material, fracture, if any, would be in the base, and not of the vertex, because the *vis inertiæ* of the skull would be overcome, and it would be driven down upon the spine, without the application of circumscribed force to the vault. The same reasoning applies when fracture of either the vault or base, or of both together, is the effect of a fall on the vertex; or this result may be varied by the blow being received on the forehead or occiput; the anterior or posterior division being thin, and severally more obnoxious to fracture."

Variety of fracture determined by site of the blow.

Injuries to the occiput are commonly followed by longitudinal fracture of the base, involving both the posterior and middle fossæ.

Injuries to the temporal region or about the ear are followed b

fracture of the petrous bone and the middle fossa; they are always serious.

But it is rare in diffused injuries to the head to find one fossa alone involved, fissures generally pass through two fossæ, and extend from the vault or part struck.

The evidence afforded by my notes of two hundred cases of fatal head injuries clearly establish these points, which have also been experimentally proved by Dr. Aran.

Dr. Aran's experiments.

"In precipitating a large number of bodies from various heights on to the head, Dr. Aran found that the part of the vault which first struck the ground gave, as it were, the key to the fracture which would take place at the base. Similar results were also obtained when diffused blows were dealt upon different parts of the skull by means of a large and heavy hammer. In the front part of the vault injuries thus produced led to a fracture of the anterior fossa; in the middle part of the vault they led to a fracture of the middle fossa; and at the back of the head to a fracture of the posterior fossa. In no single instance was a fracture detected at the base without a line of fracture in the corresponding part of the vault. The truth of this has been proved by an analysis which I made of all the cases of fractured base of the skull admitted into St. George's Hospital during a period of ten years." (Prescott Hewett.)

My own observations go entirely to prove the correctness of these views. The middle fossa is the one, however, most frequently involved.

Compound fractures of the skull are, as a rule, local fractures. They are generally the result of a concentrated blow upon, or a puncture of, the part, the force employed having been expended in producing the local injury. They are, consequently, often starred or comminuted and depressed fractures. When the brain is involved in the injury, it is chiefly beneath the seat of fracture; it is rarely shaken or concussed as much as it is in simple fractures the result of a diffused blow.

Compound fracture often followed by secondary brain inflammation.

The dangers attending a compound fracture do not, therefore, arise so much from the direct injury to the brain as from secondary intracranial inflammation, the direct result of irritation of the dura mater by the depressed or comminuted bone; the dura mater being frequently punctured or torn, and in all cases irritated by the depressed bone. These facts have an important bearing on practice, since they encourage the Surgeon to remove the depressed and irritating portions of bone which have such an injurious influence on the progress of the case. When the brain is injured by the accident, the danger is far greater.

THE DIAGNOSIS OF FRACTURE OF THE SKULL.

There are no special symptoms by which a fissure of the vault, uncomplicated with a wound, can be recognised. The best guide to the diagnosis of a fracture of the skull is the nature of the injury. Extensive fractures of this kind are constantly found upon the post-mortem table where no suspicion of their presence was entertained during life. When a wound complicates the case, a fracture can usually be made out, as the fissure can be seen as a red line. Care,

however, should be taken in these cases not to mistake a suture for a fracture.

Fracture with depression.

When depressed bone exists with fracture, the diagnosis is rarely difficult, unless it should so happen that the fracture has taken place beneath the body of the temporal muscle, when it is almost impossible to diagnose its existence by direct signs.

Sources of error.

An effusion of blood beneath the pericranium may be mistaken for a fracture with depressed bone, unless care be observed; as may a natural depression in the skull, particularly in the occipital region.

Punctured fracture.

Fracture of the skull, the result of a *punctured* wound, can, as a rule, be readily recognised, though when the point of the perforating instrument has been broken short off at the surface of the bone, much care is needed.

Fracture of base.

The diagnosis of a fracture of the base, or of the base and vault combined, is always a source of difficulty, since there are no signs but only symptoms to assist opinion. The nature of the accident is, without doubt, the Surgeon's best guide; a fall from a height or a heavy blow upon the head is the usual cause of such an accident, though a crushing force applied in any direction may produce the same result.

Through middle fossa.

Should the fall have been upon or the force applied to the vertex, the middle fossa of the skull will probably be the seat of injury; and the diagnosis of a fracture through the petrous bone may with some confidence be made when such an injury is followed by profuse or persistent hæmorrhage from the ear, succeeded by the copious discharge of a watery and perhaps saccharine or slightly albuminous fluid, and paralysis of the parts supplied by the facial nerve. Slight hæmorrhage from the ear is no positive sign; the moderate discharge also of a watery fluid alone is not characteristic; nor is facial paralysis. But profuse and prolonged bleeding from the ear, or slight hæmorrhage, followed by a watery discharge, is, however, strongly indicative of a fracture; as is also a copious watery discharge directly following the injury. Facial paralysis, however, combined with either of these symptoms, renders the diagnosis complete. This watery discharge is now generally admitted to be an escape of cerebro-spinal fluid through a fracture of the petrous bone, passing across the internal auditory canal, and attended with rupture of the membrana tympani. I have known this to continue for eight days.

Bleeding from ears.

Facial paralysis.

Watery fluid from ear.

In injuries to the mastoid process, if a local emphysema exists, the presence of a fracture may be diagnosed.

Fracture of the anterior fossa.

Should the blow or fall have been upon the anterior part of the skull, the probabilities of the case point to fracture of the anterior fossa; and where any injury to any of the nerves of the orbit can be made out, as indicated by local paralysis of some of the muscles of the eye, or when hæmorrhage has taken place beneath the conjunctiva, the diagnosis is certain. Hæmorrhage into the eyelids by itself is of no value as a diagnostic sign, although when it follows the accident at a later period and is consecutive to subconjunctival hæmorrhage, it is a symptom of some importance.

Falls upon the occiput commonly produce longitudinal fissures of the base.

ious and obstinate bleeding from the nose or pharynx is by no unfrequent in a case of fractured base, and when accompanied ther suspicious symptoms is of diagnostic value. I have the of a case of injury to the head in which the patient apparently om bleeding from the nose and mouth, no blood coming from the nd, after death, a fracture of the base was found, completely ting the petrous portion of the temporal bone from its con- is, and laying open the lateral sinus. The right tympanum ll of blood, but the membrana tympani was entire. The stomach ll of blood, the blood from the lateral sinus having apparently its way through the Eustachian tube into the pharynx and h.

Bleeding from nose.

Laceration of lateral sinus

ve also the particulars of a second case, in which the carotid was divided in its passage through the petrous bone, and the sinus laid open, the lungs and bronchial tubes being found filled lood, even down to the air-cells. Each of these patients lived wo hours after the accident.

Laceration of internal carotid.

ture of the base, unassociated with any injury to the brain is of no more consequence than fracture of another part; but as se is the most delicate part of the brain, and any injury to it is be followed by severe, if not fatal, symptoms, the subject of e of the bones upon which it rests becomes of proportionally interest.

fracture of the base may be associated with all the intra- ic injuries to which fractures of the vault are liable. It may be ated with simple concussion of the brain, or with the more form associated with laceration of the brain-structure, or ex- ation of blood upon or within the brain itself. If blood is effused may be compression of the brain followed by death, or the same may be produced by a secondary inflammation of the membranes jured parts.

Generally attended with brain injury.

difficult upon the whole to separate the two classes of cases, ch as the dangers arising from injuries to the skull do not depend he seat of fracture, but upon the injuries to the cranial contents; the same injuries may be produced by, or rather may be asso- with, fractures of the base, the complications and dangers are the each.

ing, then, so far shown that the dangers of all forms of fracture skull are really alike, and that the same intracephalic complica- ttend fractures, whether of the vault or of the base, I now pro- illustrate the special symptoms generally regarded as being tic of such injuries, by a brief analysis of cases from my note-

a. Analysis of cases as illustrating special symptoms in injury.

ng thirty examples which are there recorded, twelve were ted with simple concussion, in all of which recovery took In three cases the fractures extended through the orbit, as ed by subconjunctival ecchymosis. In eight there was hæmor- from the ears; in all, this was followed by a discharge of serum, seven of the cases it was associated with paralysis of the facial pon the same side. In these it is quite fair to conclude that e of fracture extended through the petrous portion of the tem- one. In two there was bleeding from the nose; in one there erous discharge from the ear, accompanied by paralysis of the

facial; in another this discharge followed hæmorrhage from the ear and was unaccompanied by paralysis.

b. Fatal cases.

To test the value of these different symptoms as indicating fracture of the base in various positions, the following analysis of the fatal cases will prove of value; and, taking the symptoms separately, subconjunctival hæmorrhage will first claim our attention, as being one which more or less accurately marks a fracture through the orbital plate. In the eighteen fatal examples, this symptom was manifested in four instances; the line of fracture extending in each of these through the orbit.

In two cases there was copious hæmorrhage from the ear, while in both, the fracture passed through the petrous bone.

In three examples there was some epistaxis; in one of these the fracture extended across the ethmoid bone; in another the frontal sinuses were full of blood and fractured; and in the third the tympanum was found full of blood, the membrana tympani perfect, and, upon careful examination, the lateral sinus of the brain was found to have been lacerated.

Injury of brain.

Seven of the eighteen fatal cases died from direct injury to the brain, the post-mortem examination in all revealing severe contusion or laceration of the brain-structure, with effusion of blood upon the surface of the brain or upon the membranes.

Arachnitis

Seven other cases died from arachnitis as a result of the injury. In four of these there was contusion of the brain, and in one ecchymosis of the ventricles; in two there was no evidence of contused brain, nor was there any effusion of blood; in one interesting case the inflammation spread from the internal ear. In three, the cerebral mischief was complicated with some thoracic or abdominal injury, which caused death; and in one hæmorrhage was the immediate cause of death.

Rare cases.

A severe blow upon the nose, by driving in the ethmoid bone, may cause fracture of the anterior fossa of the base of the skull (*vide* Fig. 67); and I have had under my care several cases in which a severe blow upon the jaw produced a fracture of the middle fossa. At St. George's Hospital

Fig. 67.



Fracture of anterior fossa of the base of skull.
(Prep. No. 1085[67], Guy's Hosp. Mus.)

there is a specimen in which a fracture of the base was caused by the condyle of the lower jaw being driven against the glenoid

bssa with such force that the condyle projected into the cavity of the skull; and in Guy's Hospital Museum there is a similar specimen, which was sent in with Mr. Hutchinson's prize essay. Punctured wounds of the orbit are by no means infrequent causes of fracture of the base; many are recorded. I was once called to a case in which a lead pencil had perforated the bone and the brain through the orbital plate; and Fig. 68 was taken from a preparation in which the frontal bone was perforated. The diagnosis of these cases is not difficult. When brain-matter escapes externally through the wound there is no room for doubt.

FIG. 68.



a. Punctured wound through frontal bone. *b*. Portion of wood which perforated bone. (Prep. No. 1086[60], Guy's Hosp. Mus.)

The treatment of fractures of the skull will be described after the subjects of injuries to the brain, and extravasation of blood within the cranial cavity, have been considered.

CONCUSSION OF THE BRAIN AND ITS EFFECTS.

"A man receives a blow on the head, by which he is only stunned for a longer or a shorter period. What is said to have happened? Concussion of the brain. Ordinary acceptation of term.

"A man dies instantaneously, or lingers some time perfectly unconscious, after an injury of the head; there are no marks of external violence. Again, what is said to have happened? Concussion of the brain.

"The head is opened, and what is found? In one case no deviation from the healthy structure; in another, simply great congestion of the cerebral vessels; in another, numerous points of extravasated blood scattered through the brain substance; in another, a bruised appearance in some parts of this organ. In all, the case, in common parlance, is said to have been one of concussion of the brain. Such are the after-death appearances ascribed by different surgeons to concussion of the brain."

These words of an eminent surgeon (P. Hewett) so accurately describe the ordinary teaching of the schools, that I have transcribed them as a fitting introduction to the subject of which I am about to treat. They are likewise practically true, although experience of the post-mortem room shows that in cases of death from concussion of the brain, with the rarest exception, some changes in structure are to be found if carefully looked for, some bruising or laceration of the brain, some bleeding into its substance. In fact, death from concussion of the brain without change of structure hardly ever takes place—*concussion and contusion of the brain being, as a rule, associated in fatal cases.* At Guy's Hospital, for twenty consecutive years, no case is recorded of death from concussion without change of brain-structure; and it is only quite recently that an example has occurred.

"In every case," remarks P. Hewett, "in which I have seen death occur

shortly after, and in consequence of, an injury to the head, I have invariably found ample evidence of the damage done to the cranial contents."

Concussion and contusion of brain identical.

Mr. Le Gros Clark states: "I have never made nor witnessed a post-mortem after speedy death from a blow on the head where there was not palpable physical lesion of the brain;" and Dr. Neudorfer, of the Austrian army, declares that he has never seen concussion, properly so called, except in apparently trivial injuries.

M. Fano, a recent French writer, has also come to the conclusion "that the symptoms generally attributed to concussion are due, not to the concussion itself, but to contusion of the brain or to extravasation of blood. In fact, all authorities now agree that when death follows a severe shaking or concussion of the brain, contusion or bruising of the brain is almost invariably found.

How far these views are correct in cases of concussion that are not fatal, is an open question; but in the few cases of concussion recorded in which death has followed from other causes, some injury to the brain substance has always been found; and, in all instances in which a fatal result has taken place from secondary inflammation, evidence of some bruising of the brain has been detected. A bruising of the brain, however, with a slight extravasation of blood, may be recovered from; but when there is extensive effusion, compression of the brain and death are the usual result.

Recovery of bruised brain.

When it is generally accepted as true that concussion and contusion of the brain are practically synonymous, the principles of the treatment of such injuries will be better appreciated.

Symptoms of concussion.

In the *simplest* form of concussion of a healthy brain a slight and transient loss of power and consciousness is the only symptom.

In the *more severe* form, when a blow or injury produces some severe shaking of the cranial contents, this shaking is followed by a loss of consciousness more or less complete, and a loss of all power of motion; the skin of the patient will be cold, the features more or less contracted, the pulse slow and intermittent, and the pupils very variable—in some cases they will be dilated, in others contracted, while in a third one pupil will be dilated and the other contracted. If the case be neither one of great severity nor complicated with any grave injury to the cranial contents, after a variable period the patient will show signs of movement; and may, perhaps, move a limb in an impatient and purposeless manner. If he is spoken to in a loud voice, he will, perhaps, show some signs of returning consciousness, either by making some inarticulate noise or by merely opening his eyes and afterwards returning to his stolid condition. If the case be still carefully observed, the mode of respiration may be seen to be altered; and from being slow and laboured, it will be irregular, and perhaps sighing. After a time, if recovery is to take place, other signs of what are termed *reaction* will make their appearance.

Reaction after concussion.

The skin will become warmer and more natural, the shrunken and contracted features will return to their normal condition, the pulse be more regular and rapid, and vomiting may occur. The appearance of this symptom is generally of moment, and the first result of a more active circulation through the cerebral centres. As the case proceeds if all goes well, the patient rapidly recovers and returns to his natural condition, feeling, perhaps, somewhat heavy and dull for a few days, and indisposed for any bodily and much less for

open question. In the simplest case the local injury must be slight; on the brain.
ie more severe, there is every probability that some bruising of the
n has been produced, while in the worst, laceration of the brain and
avasation of blood will probably have taken place.
what is called concussion of the brain epistaxis is very frequent, and Epistaxis.
iorrhage into the lids of both eyes is not uncommon, though beneath
conjunctiva it is very rarely met with. Hæmorrhage from the ear Hæmorrhage from ear.
ctly after the accident is occasionally seen, and I have known it
inue for several hours; the extravasation of blood takes place in
hese cases as a direct result of the accident.
gain, in certain cases, a patient, having regained his consciousness,
pses into insensibility—*relapsing unconsciousness*—from which he Relapsing unconsciousness.
recover as perfectly as if no relapse had taken place. It would
ear as if this condition were produced by the earliest effects of re-
on, the vessels yielding too freely to the heart's pulsations, and thus
lucing a plethora of the part, which induces a comatose or semi-
atose condition. The following case illustrates these points.
boy, æt. 11, having received a blow upon the head from a falling Case of relapsing unconsciousness with epistaxis.
e of timber, became perfectly unconscious and quiescent. He re-
ned in this state for fifteen minutes, but, recovering, he walked
ie some short distance. He soon began to feel sick and vomited,
vomiting being attended with *epistaxis*. He was then brought to
's, with a cold skin and labouring pulse. He was very slightly con-
us and unable to answer any questions, while his limbs remained in
position in which they were placed. The pupils were dilated, but
ve. He was left in bed with the head raised, and a cold lotion
lied to it. Warmth was applied to the feet. He gradually recovered,
left the hospital in ten days convalescent.
he epistaxis and relapsing unconsciousness in this case, coming Reaction with convulsions.
ther at the time of reaction, point clearly to the cause.
gain, in children, reaction is not unfrequently attended with con-
ions which generally, however, pass away, and leave no mark behind.
nvulsions, when they appear in an adult, are symptoms of grave anxiety,
e they almost always indicate brain injury and forbode mischief.

bruised, by what is rightly termed "contre-coup," and indeed it very often happens that the mischief to the brain by contre-coup is greater than that at the seat of blow. When the fall or blow has been upon the vertex, the base is bruised; when on the occiput, the anterior lobe; when on the right parietal region, the base of the left middle lobe; in fact, the base of the brain is almost always the seat of injury.

Hæmorrhage of brain. Diseased vessels. Hæmorrhage into brain.

The amount of extravasated blood will depend upon the degree of force applied, but when the vessels are diseased the hæmorrhage may be excessive. When the extravasation of blood is upon the surface of the brain it will be either within the cavity of the arachnoid or the meshes of the pia mater, and under both circumstances the blood will gravitate to the base. When the extravasation of blood takes place into the structure of the brain it may be found in any part of the cerebrum, cerebellum, or pons Varolii, or even in the ventricles, the extravasation rarely showing itself in the form of one large clot, but commonly in small and numerous spots of extravasation.

Results of post-mortem

On referring to my notes on this subject, I find in a case of concussion, which proved fatal sixty hours after the injury, that the brain was bruised all over, and blood effused at the injured spots; the fluid in the ventricles was blood-stained, and the ventricles themselves ecchymosed. In another case of death from concussion, the result of a fall, in a man æt. 31, in whom convulsions and coma supervened on the fifteenth day after the injury, a layer of blood was found universally diffused over both hemispheres, dipping between the convolutions and passing downwards towards the base. The clot, which was shreddy, of a dull, reddish-black colour, had evidently been effused for some days. The surface of the brain beneath the seat of injury was softened, and at the base, where it had been injured by *contre-coup*, similar changes had taken place. The vessels were healthy. In a third case, where death followed from concussion and the vessels were diseased, multiple extravasations were detected after death throughout the substance of the brain.

In all these typical cases, illustrating the different effects of "concussion," fatal results took place from changes brought about by severe shaking of the brain, unassociated with fracture; but it is to be remembered that where a fracture is present, unless it be attended with depressed bone, the shaking of the brain and not the fracture is the main source of danger.

Diagnosis of contusion. Severity and persistency of symptoms.

From what has been thus stated the conclusion may be drawn that the nature of the accident is the best guide to the diagnosis of contusion of the brain; and the severity of the symptoms, or their persistency, is, doubtless, a valuable indication as to its extent. "Tonic spasms of the limbs; intense restlessness, with constant rolling and tossing about in bed; unconsciousness, more or less complete; drowsiness, without any stertorous breathing, and in the slighter cases simply contraction of one pupil or of one eyelid; spasmodic movements about some one muscle or another of the face or lips, giving rise to a difficulty of pronunciation" are by the French surgeons looked upon as diagnostic of a contused brain; and Mr. Le Gros Clark lays stress upon the following:—"More or less constant restlessness, accompanied by spasm, in which some particular member is affected, or amounting to general convulsion. If capable of giving expression to his feelings, the patient will point to some particular part of the head as the seat

Le Gros Clark's diagnostic marks.

of pain. In some instances noisy incoherency and obtuseness of intellect accompany this condition from the first;" and these symptoms are doubtless enough to point to brain injury. When they appear rapidly after the accident, they may be accepted as suggestive of a bruising of the organ; but when they come on a few days later they are as likely to be due to secondary inflammation of the brain as to contusion.

Diagnosis of primary contusion and concussion.

The diagnosis of primary concussion and contusion of the brain, is unnecessary. The symptoms are so intermixed that the real nature of the lesion is not apparent. The signs attributed to concussion, such as loss of consciousness, collapse, small, scarcely perceptible pulse and lowered temperature, merely indicate that the functions of the brain and their influence on the system at large, are in a state of abeyance; and it can only be declared that the brain was contused in the first instance, *if the symptoms continue* or become aggravated.

Seat of injury indicated by paralysis.

The seat of injury to the brain may likewise often be indicated by some paralysis, partial or complete, of one or more of the cerebral nerves. This paralysis may be either a passing or a permanent symptom. Paralysis of the seventh pair, including the facial nerve, has been already alluded to as a somewhat typical symptom of fracture through the petrous portion of the temporal bone. This may appear as an immediate result of the injury, indicating laceration of the brain by the fracture; or, what is more usual, at a later date, when it may be the effect of pressure by effused blood upon the nerve-trunk in some part of its course; or, at a still later period, by inflammatory effusion.

Injury to the cerebral nerves, &c.

On referring to my own notes of cases admitted into Guy's Hospital at different periods during the last twenty years, I find examples of injury to the optic nerves, as indicated by blindness; paralysis of the muscles of the globe of the eye as a whole; and paralysis of the external rectus muscle alone. Paralysis of the facial and auditory nerves is very frequent, and at times there is paralysis of the fifth nerve, as indicated by complete loss of sensation of the face, &c. Paralysis of the hypoglossal has also been observed. In the majority of these cases the symptoms appeared as a direct result of the injury; in some they came on two or three days later, associated with febrile symptoms; but in most they disappeared in the course of a few weeks. In some instances, however, of facial paralysis the symptoms were permanent. In all these there must have been injury to the base of the brain. "The coexistence of hemiplegia on one side, with paralysis of the third nerve of the opposite side, is indicative of lesion of the crus cerebri on the side on which the third nerve is paralysed." (Le Gros Clark.)

Aphasia after injury.

I had once under my care a man who received a severe blow on the left side of the head above the ear. The injury was followed by symptoms of concussion, which soon passed away; but he had complete aphasia. In the course of a few days he partially recovered the ability to speak, but then spoke so thickly that he was unintelligible; in about three weeks he could be understood, but he did not recover his natural powers of speech for at least three months. During the greater part of this time he was subject to headache, which the least exercise or excess in diet made worse. There can be little doubt that in this case the base of the middle lobe of the right side had been contused. Mr. Callender tells us "that symptoms of aphasia are more apt to follow injury of a part of the left hemisphere outside the corpus striatum than any other

* 'Brit. Med. Journ.,' June 6th, 1874.

part; that injuries to the right hemisphere are more rapidly fatal than are equal injuries to the left; and that the right-side brain lesions are more often associated with convulsions than are similar hurts at the opposite side." The evidence of these opinions is not strong.

Remote Effects of Head Injuries.

Remote effects of concussion.

There are, however, many injuries to the head which, without producing such definite symptoms, as have been described as the result of concussion, &c., yet cause serious and often permanent damage to the patient.

The effects of a blow on the head are by no means to be determined by the immediate symptoms that result, for a person may receive a trifling or severe injury, from which he is supposed to have completely recovered, and yet the case may end in a permanent enfeeblement of the mental powers, or be followed by paroxysms of uncontrollable excitement. It behoves the Surgeon, therefore, to be most cautious in giving an opinion as to the issue of a case of injury to the head.

Insanity.

The records of lunatic asylums and convict prisons prove, unhappily, that many cases of apparently trivial injury to the head, unaccompanied by symptoms which would indicate any positive affection, such as concussion, paralysis, &c., have ended in an affection of the brain which has rendered the patient hopelessly demented or a criminal, and, moreover, has left no visible traces of the malady in the brain after death. The following may suffice as illustrations:

A boy, æt. 16, fell from a tree and was found partly insensible. After a few days' treatment he was dismissed from the hospital as "cured." In a few months he was obliged to be placed in a lunatic asylum, where he remained several years.

A gentleman put his head out of the window of a carriage while travelling by railway, and received a scalp wound from striking against a post. He was rendered insensible at the time, but soon improved. There were no signs of importance, yet in a few weeks he was in a state of mental aberration, and died in a year.

A man was kicked by a horse in the stomach and fell, striking his head on the stable floor, but had no cerebral symptoms. In a few weeks he got delirious and confused in mind, and became in time hopelessly insane.

Such instances might be multiplied endlessly, all pointing to the supreme importance of injuries to the head, however slight the immediate symptoms. The reader may find this subject well discussed and illustrated by Dr. J. C. Browne in the first volume of the 'West Riding Asylum Reports,' in Abercrombie's works, Dr. Azane, 'Archives Générales de Médecine,' Feb., 1881, and elsewhere.

It may be laid down as a principle that persons with any hereditary predisposition to insanity or nervous disease are more liable to suffer from cranial injuries than others. The temperate have a better chance of escape than those addicted to excesses of any sort.

INJURIES OF THE BRAIN AND ITS MEMBRANES COMPLICATING FRACTURE.

When the student has recognised the fact that a blow upon the head, *not* complicated with fracture, is capable of producing, by "concussion of the brain," injuries such as have been sketched in the previous pages, he will be quite ready to understand that a blow upon the head

complicated with fracture is likely to be followed by results that are at least equally severe, since the force required to produce a fracture of the skull is as a rule either more violent or more concentrated than that required to produce what has been described as a concussion of the brain. There are, moreover, complications which are frequently associated with or are peculiar to fracture, such as depression of bone with or without compression of the brain; extravasation of blood external to the dura mater from rupture of a blood-vessel, such as the middle meningeal artery, or venous sinus; injury to the dura mater or membranes, and direct injury to the brain. He must also be aware of the fact that a fracture of the skull may take place without producing any cerebral disturbance; for example—

Fracture without brain complication.

A man, æt. 27, received a blow over the vertex from a broken sword. An extensive scalp wound was the result, and a very evident incised wound in the upper portion of the frontal bone, apparently involving only the external table, It was not complicated with the slightest cerebral disturbance, and good recovery followed.

Incised wound of the skull.

A boy received a compound fracture over the frontal region from the kick of a horse; he had no head symptoms whatever, and he recovered.

Compound fracture of frontal bone without brain injury.

In the former case there was an incised wound of the skull, and in the latter an undepressed compound fracture. In neither was the brain materially shaken, bruised, or otherwise injured, and in both a good recovery ensued. Cases such as these, however, are comparatively rare; the more frequent being examples of fractured skull associated with brain symptoms similar to those which have been described under the head of simple concussion; cases in which the functions of the brain are for a time more or less interfered with or suspended, but which have a tendency gradually to return to their normal condition; in which the injury to the skull has been severe enough to break the bone, and general enough to shake the brain and cause a suspension of its functions. The importance of these, however, lies in the injury the brain has sustained, and not upon the fracture; the fracture being only a complication, and so long as there is no depressed bone irritating and compressing the brain, the danger is in no way increased. If, however, in any given instance, the injury is complicated with laceration of one of the large arteries of the bone, such as the middle meningeal artery or large venous sinus, other conditions may arise which produce special symptoms.

Fracture of skull and concussion.

Fractures of the Skull associated with Extravasation of Blood between the Dura Mater and the Bone.

As a result of an injury to the skull, whether with or without a fracture, small extravasations of blood between the dura mater and the bone are not unfrequent, and are due to the rupture of some of the small vessels which pass from the dura mater to the bone. They give rise to no symptoms by which they can be recognised, and usually are only discovered after death.

When any large extravasation occurs, the blood comes, as a rule, from either the trunk or one of the branches of the middle meningeal artery, which runs upward in a groove of the anterior inferior angle of the parietal bone, and divides to supply the lateral parts of the base and

Source of hæmorrhage middle meninge. artery.

vault of the cranium, or it may come from a venous sinus. A fissure, therefore, of a bone involving any of these parts may lacerate one of these vessels, and give rise to a hæmorrhage sufficiently copious to produce symptoms of compression of the brain.

It is well to know, however, that the brain will sustain a great deal of pressure without giving rise to any symptoms, and that several ounces of effused blood rapidly poured out are required to produce such symptoms as are recognisable.

The following is an excellent case to illustrate the accident:

Typical case.

CASE.—A man, æt, 49, when riding in a gig, was thrown out upon his head. The accident produced a scalp wound over the *left* side of the vertex and some slight insensibility. He got up and walked for half an hour, when he became confused, staggered, and went into a shop, being supposed by the shopkeeper to be intoxicated, but as he gradually became quite insensible he was brought to Guy's. When admitted he was perfectly unconscious and comatose, with dilated pupils, labouring pulse, and slow respiration. Soon afterwards he became convulsed, the *right* arm being more affected than any other part, in a few hours it was completely paralysed. He remained in this condition for two days, and died comatose. After death, upon removing the calvaria, which was fissured in a vertical direction from the middle of the left parietal bone to the jugular foramen, a large clot of blood was seen lying upon the dura mater, clearly proceeding from the middle meningeal artery. This was about two and a half inches in diameter, and more than an inch in thickness. It formed a *globular tumour*, and caused an extensive depression upon the left cerebral hemisphere, which pressed the longitudinal fissure to the right side. The brain itself was healthy. Prep. 1600[20] in Guy's Hosp. Mus. shows the condition. In Figs. 69 and 69A these points are well seen.

FIG. 69.



Drawing showing clot (*b*) external to the dura mater (*c*) from laceration of the middle meningeal artery (*a*) following a fracture. (Drawing 80[20], Guy's Hosp. Mus.)

Such a case may fairly be accepted as a typical example of this form of injury, and special attention should be paid to the fact, that the man recovered from the immediate effects or shock of the accident, remained sensible for a definite period, and then gradually became unconscious. In compression from hæmorrhage this "interval of time," provided it be a short time, between the accident and the occurrence of the symptoms is most important from a diagnostic point of view; it is very commonly, although not constantly, present; but, when present, it is characteristic of hæmorrhage in some form. The symptoms, to be those of compression, must also be lasting; nor must they be mistaken for the "relapsing unconsciousness" of a shaken brain, to which attention

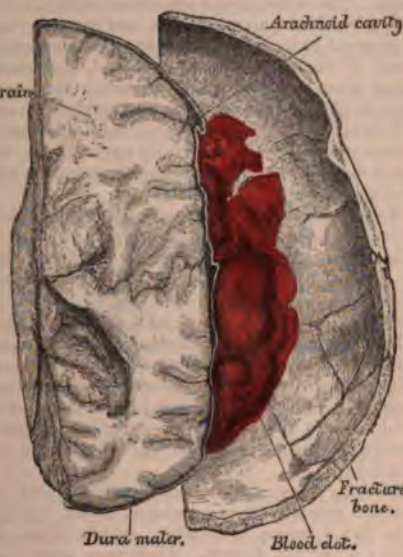
Interval of time between accident and effusion of blood.

Persistency of symptoms.

has been already directed. The persistency of the symptoms is consequently a valuable diagnostic symptom.

But, it may be asked, how is extravasation of blood outside the dura mater the result of a lacerated meningeal artery to be diagnosed from extravasation of blood either within the cavity of the arachnoid, or upon the surface of the brain, or within the brain itself? For under all these varied circumstances the symptoms may appear some time after the accident, and the inference drawn from the "interval of time" is the same in each; under all, the symptoms of compression will be identical, for they will be those of apoplexy, and, as in apoplexy, varying in each case; for "when extravasation takes place on the surface or within the substance of the brain, it is accompanied, and, indeed, produced by lesion of the cerebral texture, which lesion is mostly indicated by paralysis, by irritation and spasmodic action affecting some particular part, by derangement of the pupils, or by other symptoms" (Cock). The Surgeon's best guide, however, in forming his diagnosis will always be the history of the case and the nature of the accident.

FIG. 69A.



Transverse section of skull with cranial contents, showing fractured skull, rupture of meningeal artery, a clot of blood outside dura mater, and compressed brain. (From Prep. Guy's Hosp. Mus., 1593[61].) "A life lost that perchance might have been saved" (Goodhart).

In uncomplicated cases of hæmorrhage *external to the dura mater* the injury is generally a local one, produced by a sharp blow or fall; the brain, as a whole, is not shaken or injured; the symptoms of compression are, moreover, generally very marked and rapidly produced, and the paralysis of half the body is also commonly complete.

Blood external to dura mater.

In cases of hæmorrhage *into the arachnoid cavity, or upon the surface of the brain*, the injury is mostly of a general character, such as a fall from a height or a blow from a heavy weight; the whole brain having been violently shaken or "concussed," and, as a result, its delicate structure, more particularly that of the base, has been bruised or lacerated, weak or diseased vessels being very apt to give way, produc-

Blood internal to dura mater.

ing hæmorrhage. Hæmorrhage external to the dura mater may, it is true, be present in these cases of general injury, but it will be complicated with extravasation into deeper parts; and this point of diagnosis is all important, since in the former class of cases, when the blood is between the bone and dura mater, surgical treatment may be of inestimable value, whilst in the latter it can be of no service.

Hæmorrhage on surface of brain after fracture with bruised brain.

Hæmorrhage upon *the surface of the brain* is a very important subject, occurring in variable degrees in every case of severe or general injury to the skull, whether complicated or not with fracture; the brain itself may be not only bruised at the seat of injury, but it will be equally, if not more, injured at the opposite point by *contre-coup*; and this bruising and extravasation is generally found at the base of the brain. The hæmorrhage associated with this bruising may be so slight as to give rise to no symptoms, and recovery may take place; or it may be so great as to induce symptoms of compression. But when a large vessel of the pia mater is ruptured, the bleeding will be severe, and under these circumstances the blood may spread into all the parts down to the base, covering in the cerebellum and spinal cord.

It is this fact that renders all cases of *general injury* to the brain so serious, and tells so powerfully against any operative interference in such a class of cases; the Surgeon being quite unable to reach the source of compression by trephining.

Hæmorrhage into cavity of arachnoid after injury.

Hæmorrhage *into the cavity of the arachnoid* is by no means a common consequence of head injury, but it may occur as a result either of a local, or direct, or of a diffused, injury to the skull; and the effused blood may be poured out upon one or both sides of the cerebrum. When the effusion is gradual and not extensive, no definite symptoms of compression will be produced; but when extensive, although symptoms of compression may appear, there will be nothing to indicate the precise position of the hæmorrhage.

Patients with kidney disease.

In patients who have albuminuria or diseased arteries, there is reason to think that a slight injury to the head may cause extravasation of blood into the arachnoid, and this fact has an important practical bearing, furnishing a key to the solution of many a doubtful case of head injury.

Arachnoid cysts after hæmorrhage.

Pathology has taught us that blood clot may organise and form what are now known as arachnoid cysts, having smooth external surfaces like a serous membrane; which, when recent, will be soft and pulpy; when old, fibrous. They may contain only serous fluid more or less blood-stained, or clots of blood altered by time. Sometimes these cysts are found to be loose in the arachnoid cavity, at others fixed to the parietal arachnoid. They are usually found *accidentally* after death in those who have suffered from mental disorder or general paralysis, and although more commonly they exist on one side of the head only, they are sometimes found on both.

Dr. Crichton Browne ('Journal of Psychological Medicine,' December, 1875) tells us that out of 1240 post-mortem examinations made at the West Riding Asylum, there were 59 examples of arachnoid cysts: 43 occurred in males, 16 in females, and the majority were in the left side. In half the cases general paralysis was the cause of death. Dr. Browne does not think that these cysts have a traumatic origin, but are due to the rupture of a vessel from cerebral hyperæmia.

To Sir Prescott Hewett ('Med.-Chir. Trans.,' vol. xxviii) must be assigned the credit of explaining how these cysts are formed from a chronic change in previously effused blood. For a full elucidation of the subject, however, we are indebted to Drs. Wilks, Ogle, Bacon, and Sutherland ('Journal of Mental Science,' vols. x and xi; 'Rep. West Riding Asylum,' vol. i).

COMPRESSION OF THE BRAIN.

Varieties.

The brain may be compressed in many ways, though there are four special causes of compression:—Compression from "*depressed bone*," the result of fracture, simple or compound; compression from the "*extravasation of blood*" into any part of the cranium; compression from the "*formation of matter*" between the dura mater and the bone; and compression from the "*effusion of inflammatory products*" into the brain or its membranes.

Onset of symptoms in each variety.

The symptoms of compression under all these different circumstances are much alike, although the clinical history of the cases and the date of the appearance of the symptoms after the injury vary in each class. When the symptoms are due to depressed bone, they follow immediately the accident. When caused by extravasation of blood, there is almost always some interval of time between the accident and the accession of the symptoms, although that interval may be but short. When caused by the effusion of inflammatory products into or on the brain, the symptoms generally appear some days after the accident, and are gradual; and, when the result of the formation of matter between the dura mater and the bone, the symptoms rarely show themselves for two or three weeks after the accident. In both of the latter classes of cases, moreover, headache and other inflammatory symptoms coexist.

Symptoms those of apoplexy.

The symptoms of compression of the brain are those of apoplexy, and their severity depends entirely upon the suddenness and amount of the compression. The skull may be fractured and the bone depressed, and still no symptoms arise. Extravasation of blood may also take place to a limited degree within the skull, and not be recognised. There is good reason to believe, indeed, that a considerable amount of blood may be poured out *slowly* upon the surface of the brain without giving rise to compression, the brain gradually accommodating itself to the pressure. The most marked cases of compression are usually due to rapid extravasation. When the bones are much depressed, or when the brain is *suddenly* compressed by the local effusion of blood, symptoms show themselves, such as complete insensibility, slow, difficult, and perhaps stertorous respiration, and a full, slow, labouring pulse. In very severe cases the respiration will be of a peculiar *puffing* character. There may also be complete loss of the power of swallowing, inability to retain fæces, and retention of urine—incontinence or overflow of urine being the last symptom. The pupils may be either dilated or contracted, but they will be always fixed, and will not respond to light. Whereas in alcoholic coma, Dr. MacEwen tells us, "the pupil is contracted when the person is left undisturbed, and it is dilated when an attempt is made to rouse him" ('Glasgow Journal,' Jan., 1879).

Condition of pupils.

When the brain is widely and uniformly compressed the symptoms

are "general," *i. e.* one side is not more paralysed than the other. When the compression is *localised*, the paralysis is partial and corresponds with the region affected; though when extravasation is extensive the general effect may mask the local symptoms. The best examples of this form of limited compression are found in cases of fracture of the skull from a local injury, and extravasation of blood between the bone and the dura mater. The case quoted on page 268 is a good one in point, though the following is probably a better, as it is complete.

Hæmorrhage between bone and dura mater without fracture; trephining; recovery.

J. P—, æt. 46, a painter, having fallen from a height upon his head on a piece of iron, received a severe scalp wound on the right side of the median line of the head, with slight concussion. He was admitted into Guy's under Mr. Cock's care in 1841, conscious, and remained so for eleven hours; four hours later, however, he was found in a state of utter unconsciousness, with stertorous breathing and insensible pupils. He continued gradually to get worse. The left arm and leg when pinched were readily retracted. The right side was completely paralysed. No fracture could be discovered. Trephining was performed above and behind the anterior inferior angle of the left parietal bone over the trunk of the middle meningeal artery; a large piece of bone was removed. A gush of blood then took place, and a large coagulum was removed from outside the dura mater. The deep stertor at once ceased, and the next day the man moved his right arm and leg freely, and recognised his wife. He progressed favorably after the operation, though recovery was retarded by bone exfoliation. He resumed his work and occupation, and continued in good health for *thirteen years*. During this period, however, he had at intervals exfoliation of some portion of the skull at the seat of injury; in the ninth year he had fits, which during the last six years of his life recurred at intervals, the attacks, as Mr. Cock reported, becoming gradually more frequent and severe in their character. Six months before his death he had paralysis of the opposite side of the body to that of the injury; the face was included in the paralysis, and his speech was somewhat affected. He died after a severe apoplectic fit. After death the brain beneath the injured bone was found softened and adherent to the skull; and it contained a recent clot of three or four ounces of blood, which filled the ventricles. "It appeared probable," says Dr. Wilks, who made the examination, "that a softening had been going on for some months in the middle hemisphere of the brain, involving the contiguous surfaces of the corpus striatum and thalamus, and that at last a rupture of the vessel had taken place, infiltrating all these diseased structures, as well as the ventricles." The trephine opening was filled in by a tough membrane; and around its margins there was evidence that considerable ostitis had taken place. (Cock, 'Guy's Hosp. Reports,' 1857.)

a. Local injury and local paralysis.

When a patient receives a direct blow upon one side of the head, causing a fracture with depression of the bone, and attended with paralysis of the opposite side of the body and a fixed and dilated pupil on the side of the injury, the conclusion is inevitable that the depressed bone is the cause of the paralyis, by producing pressure upon the brain; the depression must, however, be very great to give rise to such symptoms.

When a patient sustains a similar injury, with or without depres-

sion of the bone, but followed after a distinct interval of time by paralysis of one side of the body, whether of the injured side or not, it is quite fair to assume that hæmorrhage has taken place inside the skull, and is the cause of the compression.

In both these cases a local injury is followed by local mischief, causing a local paralysis, consequently surgical treatment is of great promise.

b. Effect of general concussion of brain, with or without fracture.

When a patient receives a general injury to the head—such as commonly results from a fall upon the head from a height or a diffused blow from a heavy falling body—and this is followed directly or after an interval of time by symptoms of compression, whether associated or not with a fracture, the paralysis is, as a rule, general; and even if more complete on one side than another, the injury to the brain is, for the most part, too diffused or extensive to admit of surgical relief. The case is clearly of a mixed nature, contusion or laceration of brain-structure being associated with hæmorrhage.

Symptoms of brain injury

When a patient suffering from brain shock, with or without a fracture, is unconscious, motionless, and perhaps pulseless; has lost control over the action of the bowels and the bladder; and has a feeble respiration and paralysed pupils, it is impossible for the Surgeon to form any opinion as to the nature of the cerebral injury. These symptoms may be the result of so-called concussion, from which recovery may take place, and not of severe brain contusion; they may be associated with bruising of the brain and extravasation of blood, not sufficient, perhaps, to cause fatal compression of the brain-structure, but enough to set up cerebral symptoms, which cannot pass away for many months under the most favorable conditions; or they may be accompanied by severe brain laceration or extravasation of blood upon or into its structure, which will prove fatal by coma. The position of the extravasation has no influence on the symptoms, although it would appear that death is very rapid when it takes place into the ventricles.

Diagnosis between concussion and compression

The primary symptoms of severe concussion and of general compression are identical, and are often not to be distinguished; both may be the result of the same kind of accident. "But," says P. Hewett, "there is this marked difference: in concussion the effects are instantaneous, and in compression from extravasated blood some little, it may be very short, time elapses before the symptoms manifest themselves. In the former, also, the symptoms gradually pass off, but in the latter they become more and more marked."

"The symptoms of concussion may be continued or renewed either by extravasation of blood, pus, or both" (John Hunter, MS., 1787).

"The diagnostic signs of concussion and compression are, no doubt, distinct in a certain sense, yet compression rarely exists as a consequence of violence without concussion, and both are complicated with shock. Further, symptoms of simple concussion may become developed, at a later period, into those which indicate some more serious lesion; and it is in exceptional cases only that we can identify, with any degree of certainty, the efficient and sole cause of compression. Thus, in the stunning effects which succeed a blow on the head, if we can rouse a patient from his state of unconsciousness, even for a few moments, if the breathing is calm and noiseless, if the pulse is feeble, the pupils are contracted and reflex action can be excited, we conclude that the condition is one of concussion. The intensity of the effects of so-called

concussions are marked by the character of the symptoms and by their duration. The probable explanation of protracted somnolence and other evidences of brain disturbance is the presence of diffused extravasation of blood over the surface of the hemispheres." (F. Le Gros Clark.)

Hæmorrhage into brain with fracture.

Again, in a general shaking of the brain, blood may be extravasated into the brain itself, and when the injury has been sufficient to produce fracture there is no limit to the amount of hæmorrhage or its seat. "But in dealing with such cases great caution is necessary in order to avoid, if possible, mixing up cases of apoplexy with those of traumatic effusions. An accident coexisting with an extravasation of blood into the cerebral substance does not necessarily imply cause and effect. The previous condition of the brain or the outpouring of blood from diseased vessels may, in fact, have been the cause of the accident." (Hewett.)

Cases.

On referring to my notes I see that in a case of brain injury which lived only one hour blood was found filling the ventricles. In another the ventricles were bruised and the septum lucidum lacerated. In other cases blood was poured out into the thalamus opticus or into the corpus striatum.

In all these the brain had been severely shaken, the hæmorrhage being doubtless the result of the shake and the cause of death, while the fracture of the skull was merely a complication.

General summary.

It has been already shown that concussion of the brain too often implies contusion or laceration of its structure, with extravasation of blood, and, in the same way compression indicates as severe if not more severe injury. Concussion does not by itself produce definite symptoms, and when paralysis, vertigo, sickness, or other such phenomena arise, the inference is that there is some structural damage to the brain. Compression implies a more severe degree of the same sort of injury with effusion of blood or depression of bone. Compression of the brain, when not excessive, is seldom the *direct* cause of death. It proves fatal in the majority of cases by being the starting-point of an intracranial inflammation; since it has been proved that blood can be absorbed or encysted, and depressed bone may be gradually raised by the brain itself, or, the brain may accommodate itself to the pressure.

Compression of the brain, as a result of traumatic encephalitis, will receive attention in a subsequent page.

Wounds of the Brain.

Escape of brain through wound.

In some injuries to the skull the brain may be wounded or lacerated, and brain-matter may even escape from the wound directly after the accident. Such accidents are always of a very grave nature, and, as a rule, fatal. Wounds of the anterior and upper portions of the hemispheres are the least dangerous; wounds of the posterior hemisphere or base of the brain the most so. Recovery may, however, at times follow very severe injuries when no secondary inflammation takes place.

When brain-matter is pressed out of the skull in cases of fracture base, a grave injury is always indicated, since the crushing force must have been severe to have given rise to such a complication. Some remarkable instances of recovery after the escape of brain-matter a

however, recorded; and several have passed under my own observation, but they are too rare to be dwelt upon as holding out any hope in bad cases. Foreign bodies may likewise lodge in the skull for a long period without causing death. Wounds of the brain are not characterised by any special symptoms apart from those of concussion or compression.

Wounds of the dura mater are probably as dangerous as wounds of the brain, for inflammation of the membranes is readily set up by such injuries. It is from this fact that compound fractures of the skull are so serious; that simple fractures associated with comminution of the inner table of the skull are so often fatal; and that punctured fractures have so dangerous a tendency; for in all these cases the dura mater is not only torn, but irritated, by the projecting spiculæ of bone, and secondary inflammation is the result. This inflammation, as a rule, rapidly spreads over the brain and causes death. Wound dura m

Wounds of the dura mater, as well as wounds of the brain, are, sometimes, recovered from, but the prognosis in either case must be unfavorable. Prognosis.

Fig. 70.



Hernia cerebri.

Hernia cerebri, or protrusion of brain-matter alone, or brain- Hernia cerebri and its treatment.
r mixed with inflammatory products, is always the result of
nd or slough of the dura mater, secondary either to a com-
fracture or to the removal of fractured or diseased bone
probably always associated with some suppuration (local)
brain, due to extension of inflammatory mischief to that
contact with the diseased dura mater and bone. It is to
ed with great caution. Some surgeons are in the habit of
off the projecting mass, others of applying pressure; but
the best practice lies in doing very little, in keeping the
an and dry, and leaving their repair to natural processes.
cal affection be so limited in its nature as to be capable

of repair, the projecting mass will slough naturally after a time, and cicatrisation will follow; whereas interference on the part of the Surgeon does harm. The best treatment is at first to apply a piece of lint to the part, and, at a later stage, to keep the hernia dry by dusting it with oxide of zinc or powdered alum. Excision and the application of caustics or pressure, do not appear to be satisfactory forms of treatment.

The experience of army surgeons during the American war confirms these observations.

INFLAMMATION OF THE CRANIAL BONES, BRAIN, AND MEMBRANES, THE RESULT OF AN INJURY TO THE HEAD.

In all cases of injury to the head, simple or severe—attended or unattended by fracture; in all cases of concussion, contusion, compression or laceration of the brain, or of injury to the dura mater, inflammation of the bones, of the brain, or of its membranes, is liable to arise, and when it does, it is a very grave complication. It is this fact which makes all injuries of the head, even simple contusions of the bone, sources of danger, because inflammation, commencing in the bone, too frequently spreads inwards to the membranes of the brain and to the brain itself, and thus destroys life. The free communication between the pericranium and the dura mater, by means of the blood-vessels of the diploë, is a probable explanation of this occurrence in simple scalp and bone contusions. In injuries to the bones of the skull, and to the brain or its membranes, the liability to encephalic inflammation appears to be greatly determined by the severity of the accident.

Encephalic inflammation.

In the present chapter, traumatic encephalitis, *acute* and *chronic*, as the result of brain shocks, whether with or without a fracture, will claim attention.

Common cause of death in head injuries.

The *acute* or diffused form of arachnitis is the cause of death in most of the cases of head injury that survive the immediate results of the accident.

Acute, result of general shaking of brain.

These cases, for the most part, are the result of a severe *general* shaking of the brain, with or without fracture, complicated with contusion or laceration of the brain-structure or its membranes. They are consequently cases of arachnitis and inflammation of the brain-substance itself, the inflammation of the membranes being general. "I have never known," says Wilks, "such an affection as arachnitis spring up as a spontaneous disease, and therefore when met with you should always look for some mischief without. When arising in this way, the interarachnoid effusion is often purulent, and so copious that it may pour out when the dura mater is removed. I have never seen extensive effusion into the interarachnoid space without an injury to the head."

Chronic result of injury.

The *chronic* cases are, for the most part, the result of a *local* injury and begin in the bone, spreading inwards to the dura mater, and at last involving the two layers of the arachnoid membrane, the pia mater, and even the brain itself. Localised suppuration is frequently found in these cases, either between the bone and dura mater, or in the brain itself, from extension of inflammatory action from within.

Suppuration in brain by extension of inflammation.

inwards. The same localised changes may take place in all cases of chronic ostitis of the calvarium, whether from accident or disease.

The symptoms of the acute affection appear in the stage of reaction, indeed, they may be looked upon as indicating reaction in excess, febrile symptoms, headache, convulsions or convulsive twitchings, delirium or mania more or less acute, terminating rapidly in paralysis, coma, and death, being the general order of symptoms. Effusion of serum takes place into the ventricles and upon the brain, causing at times compression; or effusion of pus or puriform lymph occurs either upon the brain itself, or in the meshes of the pia mater, or into the cavity of the arachnoid.

Reaction in excess.

Whenever the brain has been severely shaken and consequently bruised or lacerated, inflammation may appear at the injured spots; hence it at times shows itself *beneath the seat of the blow*, but more frequently begins on the opposite side of the brain to the seat of injury, where the brain has been *bruised or lacerated by contre-coup*; from these centres inflammation may spread either to the membranes from the cortical structure of the brain, or to the substance of the brain itself; thus, in all cases of a general shaking of the brain, the seat of inflammation is in most cases at the base of the brain. The pia mater and cortical substance of the brain are commonly the seats of inflammation, but the cavity of the arachnoid is likewise involved in many cases secondarily by extension of the morbid action. There are no symptoms by which the precise seat of inflammation in the brain or its membranes can be made out; they are alike in all cases.

Seat of origin of inflammation.

No indications of seat of inflammation.

In chronic encephalitis the symptoms may show themselves soon after the injury, but, as a rule, they do not appear for weeks, or even for months. They are most insidious in their nature; they may begin by want of sleep, with an irritability of brain and inaptitude for any bodily exertion; but headache of a constant exhausting kind, aggravated by mental or physical exertion, is a most prominent symptom. As the disease progresses the patient gradually becomes emaciated and exhausted, and towards the close of the case epileptiform convulsions, local paralysis, and coma supervene.

Symptoms of chronic encephalitis.

It will thus be seen that the two classes of cases of acute and chronic encephalitis are distinct in a measure. The *acute* is the result of a bruising of the brain by a severe shaking or concussion, the bruising being, as a rule, at the base of the brain by contre-coup. The inflammation begins in the pia mater, spreads outwards, and is for the most part diffused and not local. Consequently it is *beyond* the reach of surgical operation. The *chronic* is generally the result of contusion or fracture of the bone, and local in its action. It involves, by extension from without, the dura mater, the arachnoid, pia mater, and brain consecutively in the same way. It is consequently *within* the reach of surgical art, particularly in its early stage.

Treatment of encephalitis.

Treatment.—Acute encephalitis when following a general injury to the brain, for the most part runs such a rapid course that there is little time for treatment to take effect. It attacks patients, moreover, who have been already knocked down by the injury in more ways than one, in whom there is rarely much resisting force, and there is consequently not much chance of success by treatment. Still there is much to be done.

The head must, of course, be shaved and raised on a pillow, and cold

Head shaved and raised. Ice to head. should be applied to it, by means of one of Leiter's coils (Fig. 8½, p. 48), or an icebag where the former instrument cannot be obtained. The ice when applied in a bag must be broken up into small fragments, while the bag containing it should be large, in order to cover the whole vault of the skull. The cold douche is also a powerful remedy. Free purging should be resorted to, the old dose of calomel mixed with butter introduced into the mouth being probably the best mode of administration; or an enema of turpentine or castor oil may be administered.

Free purging. Enema.

Bleeding. In a strong man, when symptoms of acute encephalitis appear after a slight injury, bleeding is a most valuable practice. It should be performed boldly and freely at the first onset of the symptoms, so as to take effect upon the patient—during the state of excitement, before effusion has taken place, and brain oppression appeared, and it may be repeated. In severe general injuries it is useless. Some employ leeching and cupping on the nape of the neck, and speak highly of the practice.

Blisters. French surgeons still emply blisters to the scalp, but these cannot be compared in value with bleeding and the local application of ice in the early stage of the affection. In the chronic stage they may be beneficial. When they are employed they should be applied to the nape of the neck, and where mercury is relied upon, the latter may be used in the form of an ointment to dress the blister. Antimony is still given by some surgeons of eminence. I have no experience of its use, and therefore cannot recommend it. When recovery takes place—a rare result—the patient must be cautioned as to the future, for any excess of diet or of mental or physical exercise may produce a relapse. The greatest quiet ought to be observed for many weeks, and the patient should live on the simplest food. Milk diet and animal broths are sufficient for some time, solid animal food being taken with great caution. Stimulants should only be administered if the patient's powers are feeble.

Diet. Rest.

Calomel. In chronic cases calomel, given in small and repeated doses to touch the gums, combined or not with opium, has its advocates, and patients, doubtless, have recovered under its use. The grey powder in three- or four-grain doses, with five grains of Dover's powder, is a useful combination when delirium is present; and at times larger doses of opium or morphia may be given. Great care, however, must be observed in the use of these drugs, for unless they are carefully given and their effects watched, they are injurious.

When symptoms of compression of the brain follow those of acute encephalitis the result of a *general injury* or shaking of the brain, there is little doubt that its compression is due to the effusion of inflammatory fluid into, upon, or beneath the brain, and under such circumstances the question of surgical interference should not be entertained. Such is to be thought of only in cases of local *chronic* suppuration, the result of a local contusion of the bone, or other injury, or of disease, and when the seat of suppuration is usually between the bone and the dura mater. At times, however, a local abscess is formed in the cavity of the arachnoid; and under the circumstances when strong evidence of this condition exists, the parietal layer may be punctured, since good results have followed this practice.

Puncturing the brain for suppuration. In more advanced cases, suppuration may involve the brain itself, and it is a serious question whether a surgeon is ever justified in puncturing this organ with a view of laying open the suppurating

cavity. Should, however, good evidence exist of suppuration in the cerebral hemisphere beneath the seat of injury, I have no doubt as to the Surgeon being justified in making an exploratory puncture, for Mr. Holden has recorded in 'St. Bartholomew's Hosp. Rep.' for 1873 a case, and Mr. Hulke others; and in the 'American Journ. of Med. Science' for July, 1873, five other instances may be referred to in which success followed this practice. Dupuytren had a successful case of the kind, and pathological anatomy furnishes examples in which such a practice might have been of use. On the other hand, many bold attempts are on record in which surgeons have punctured the brain to relieve symptoms of suspected suppuration in its substance. Weed's case is without doubt the best, as it was successful ('Nashville Journ. Med.,' April, 1872), but Detmold's and Maisonneuve's are encouraging.

I am disposed to think that surgeons are too apt to leave these cases alone too long, and allow them to get beyond relief.

Symptoms of local ostitis after contusion of cranium.

A man receives a blow upon the head, followed by passing symptoms of so-called concussion; he has a slow convalescence, attended, and perhaps followed, by headache. He may display some irritability of brain, inability to do much work, or to undergo any physical fatigue; some febrile disturbance may perhaps manifest itself, but as often as not none appear. The pulse probably will be feeble and irritable, at other times slow and labouring. On examining the seat of injury, tenderness on pressure may be experienced, and occasionally increase of heat will be felt. Pressure upon the injured part may even excite a convulsion where such had previously occurred. Under these circumstances, which are fairly indicative of local inflammation of the bone, spreading inwards—though how far is uncertain—a free incision to the bone is of great value. I have known this operation relieve immediately all the symptoms, general and local, and have never known it followed by harm. It should always be performed when evidence of local inflammation exists, with undefined and persistent brain symptoms.

Treatment by free incision.

Symptoms of abscess beneath bone.

When, however, evidence exists that the inflammation has spread from the bone to the parts beneath, as indicated by symptoms of feverishness, severe headache, and probably rigors; with sleeplessness, delirium, convulsions, and paralysis, particularly when hemiplegic, other surgical treatment may be thought of; for if these symptoms are associated with such a history as has just been sketched, there is every probability that suppuration exists within the skull, and that surgical art may reach it. General treatment, moreover, in these cases is both unsatisfactory and unsuccessful; and, if the case be left alone, bad results always follow. Surgical interference, it is true, as a rule is not very satisfactory, though some striking examples of success exist. In the hands of Pott, trephining the skull for matter beneath the bone outside the dura mater yielded a good result in five out of eight cases. No modern surgeon, however can show a like success; "indeed," says Sir P. Hewett, "the successful issue of a case of trephining for matter between the bone and dura mater is, I believe, all but unknown to surgeons of our own time." Nevertheless, the operation is clearly justifiable under such severe circumstances as have been described; for our want of success is probably due to the fact that surgeons are too readily disposed in these cases of local encephalitis to wait

Question of trephining.

Necessity of early interference.

too long, to trust too far to nature's own processes, and by so doing, to allow the local suppurative action to spread inwards beyond the dura mater to the brain itself, when the prospects of a successful result are certainly poor. They wait for what are called well-marked brain symptoms—coma and hemiplegia—before they interfere; which well-marked symptoms too often mean fatal brain complications. Trephining the seat of injury, therefore, under such circumstances is clearly a justifiable if not a hopeful measure, should the operation be performed as soon as it is manifest from the history of the case that the local action is spreading. When pus is found between the bone and the dura mater great hopes may be entertained of a successful issue, although when the same suppurative action has involved the cavity of the arachnoid and the brain, the prospect is not good.

Puncturing dura mater in suppuration.

Symptoms justifying such a step.

Should no pus be found, however, between the bone and dura mater, is the surgeon justified in opening the membrane? Without doubt he is when there is strong reason to believe that pus exists; when the dura mater on exposure *bulges* firmly into the opening in the bone which has been made with the trephine, and is *tense*, as well as absolutely *pulseless;* for cases of success after this operation have been recorded by Guthrie, Roux, Dumville and Hulke. The evidence required to sanction any incision into the brain in search of suppuration, as has been already stated, must be very strong.

Encephalitis as result of pyæmia.

Acute encephalitis, as a result of blood-poisoning, needs only to be mentioned. It is a hopeless condition from the first, and is always associated with the worst and most general form of pyæmia.

TREATMENT OF CONCUSSION AND COMPRESSION OF THE BRAIN, AND OF FRACTURES OF THE SKULL.

General remarks.

"A mere crack in one of the bones of the cranium, *abstractedly considered*, is not more likely to produce any serious complaints than a simple fissure in any other bone; and if symptoms of consequence do frequently attend the accident, they proceed either from the bone being beaten inwards, so as to press upon the brain, or from the mischief done to the parts within the skull by the same force that broke the bone itself. The same violence which breaks the cranium may occasion a concussion of the brain, an extravasation of blood in or upon it, or subsequent inflammation of that organ, and its usual consequences."

Sam. Cooper.

The truth embodied in this extract renders it necessary to consider the treatment of head injuries as a whole; since it is impossible to say, in any case of severe injury to the skull, whether two or more of the conditions mentioned are not associated.

Treatment in early stage to be expectant.

When brain concussion has taken place, it may or may not be associated with fracture; and it may or may not be followed by symptoms of compression, either from extravasation of blood or secondary inflammation; and when a fracture is known to exist, either with or without depression of bone, the difficulty is not lessened. The symptoms may be a mere temporary suspension of the brain's functions, or as they are commonly called those of a passing concussion, or they may be of a much more serious nature, and such as indicate brain contusion, lacera-

tion, or blood extravasation. The severest complications are often ushered in by the mildest symptoms; and therefore the Surgeon should always treat every case of injury of the cranium and its contents as serious. He should also be as guarded in his prognosis as he necessarily is uncertain in his diagnosis.

Treatment of mild case of concussion.

In any case, therefore, of concussion, however slight, the patient ought to be kept quiet, and should observe moderation in diet, take little or no meat, and avoid all stimulants. If he moves about, it is at risk—a risk of fatal secondary inflammation of the shaken or bruised brain. These precautions should be continued for at least three weeks.

Of severe concussion.

In severer concussion, in which, after an injury to the head, there is a more or less complete suspension of the functions of the brain, whether with or without a fracture, equal care is needful. Should the collapse indicative of the first stage be severe, reaction may be hastened by means of warmth to the body generally, more particularly to the feet, and by the application of some stimulant to the nostrils. It is seldom right to do more than this; because if reaction does not set in naturally, and is not hastened by the means mentioned, it is tolerably certain that the brain mischief is of a severe if not fatal character. Under these circumstances any more powerful means, such as the administration of alcoholic stimulants or powerful enemata, are likely to excite reaction to excess, and either encourage secondary hæmorrhage or inflammation within the skull.

Collapse.

Caution in hastening reaction.

Avoid alcoholic stimulants.

Reaction and its treatment.

When *reaction* has set in after the collapse—the *second stage* of authors—every source of excitement, mental or physical, should be removed. The patient should be kept in bed with his head raised and shaved, and the bowels emptied with a mild saline or mercurial purge. Leiter's coil (Fig. 84), cold lotions, or an ice-bag should be applied to the head, and particularly if it be hot, the pulse rapid, and other symptoms of general febrility and brain excitement show themselves. When the symptoms of excessive reaction are persistent, the commencement of traumatic encephalitis should be suspected, and under such circumstances venesection boldly performed is a valuable remedy. It may even be repeated should the symptoms return and the pulse and temperature rise. In feeble patients, however, bleeding is inadmissible, and under all circumstances it ought only to be resorted to after careful consideration.

Venesection.

The diet should be liquid and of a simple kind. Milk, when it can be taken, is the best, but when it cannot, weak beef tea or broth should be given, and then only in moderation.

Treatment of fracture and concussion.

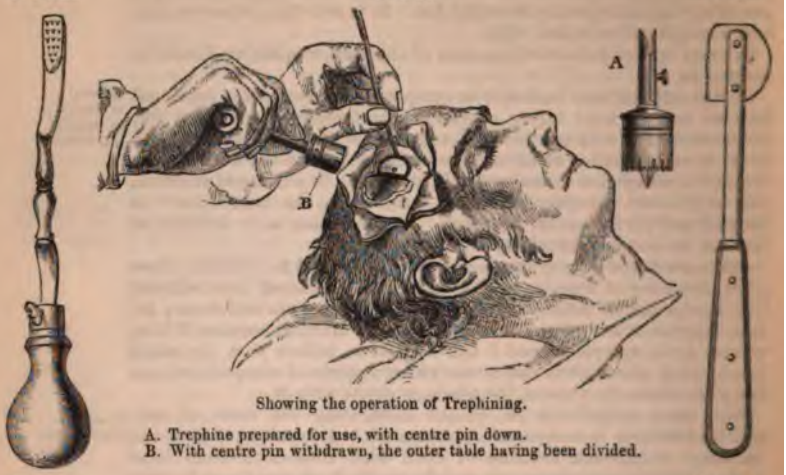
Concussion of the brain, complicated with either simple or compound undepressed fracture of the vault or fracture of the base, is to be treated upon like principles, and with equal persistency and care, for simple fractures of the vault, compound fractures of the vault, and simple fractures of the base or of the vault and base combined, *unassociated with displacement*, require no special treatment beyond that indicated by the brain symptoms.

It should be here stated that the treatment of all these conditions is to be continued for at least a month or six weeks after the injury, since there are many cases on record in which secondary inflammatory symptoms appeared at least a month after the accident, or after the subsidence of the primary symptoms.

Treatment of compression.

Treatment of compression.—*When the* brain symptoms following

Fig 71a. Fig. 71. Fig. 71b



Showing the operation of Trephining.

A. Trephine prepared for use, with centre pin down.
B. With centre pin withdrawn, the outer table having been divided.

Elevator. Hey's saw.

Circumstances under which trephining is of use.

First.—To relieve compression of the brain due to either depressed bone or extravasation of blood.

Secondly.—To prevent, check, or relieve irritation of the brain or its membranes when caused by (1) depressed and comminuted bone, by (2) inflamed and swollen bone (whether the result of accident or disease), or by (3) an accumulation of pus between the bone and dura mater compressing the brain; and it may be stated at once that the operation of trephining gains more support from the second than from the first group of cases.

Trephining for depressed bone or extravasation rarely wanted.

With respect to the first it will have been gathered from preceding chapters that depression of the bones of the skull is rarely sufficient of itself to give rise to persistent symptoms of compression; that when it is, the injury has probably been of such a severe nature as to produce grave intracranial complications, from which any operation would be incapable of affording relief; and that hæmorrhage between the bone and the dura mater is rarely so uncomplicated with brain mischief as to render it probable that the operation of trephining will be successful.

Only justifiable when the symptoms are very marked.

When, however, it can be fairly determined that brain symptoms of a defined and aggravated character are the result of either of these two causes, separately or combined, the operation of trephining may be performed. In diffused injuries to the skull the probabilities are all against the operation; while in local injuries they are in its favour.

In both simple and compound fractures of the skull, with or without depression of bone, the symptoms of compression of the brain, as a primary result of the accident, must be very marked indeed to justify the operation of trephining; although in *compound fractures* it is expedient to elevate depressed bone, when any symptoms of brain irri-

manifest themselves, such as local pain and weight, spasms or Elevation of depressed bone in compound fractures.
lsions; and that under all circumstances it is best to remove
ments when the bone is comminuted. In a compound comminuted
ure of the skull, the dura mater is probably exposed, and is like-
irritated by the broken bone. A careful elevation of the depressed
m of the bone and the removal of the comminuted fragments Remove fragments of bone.
in no way add to the mischief, but must tend towards its
nution.

local injuries whether simple or compound, when incipient sym- Trephine when incipient symptoms of encephalitis exist.
ns of brain irritation or inflammation appear two or three days after
injury, the use of the trephine is indicated, inasmuch as there is a
bability that the symptoms originate in the presence of a frag-
t of bone irritating the brain or its membranes, which if left, must
up encephalitis.

n all cases of *punctured fracture* the trephine should be employed.

When an abscess can be made out as existing between the bone and the Pus between dura mater and bone.
a mater after a head injury, the operation of trephining is demanded,
ugh the diagnosis of such cases is difficult. The chief indications
found in the prolonged period which frequently elapses between
injury and the supervention of the symptoms, their gradual and, it
y be said, irregular approach, the general and cerebral irritation
t is present as a rule, the exacerbation of all these symptoms, and,
ve all, the constant headache.

The direct symptoms of compression produced by the formation of
are, moreover, in no ways so definite as those afforded by blood ex-
vasation; they are of a less decided nature, and are never associated
h the deep-toned stertor and rapid progress of the symptoms,
hich, with overwhelming influence, quickly annihilate both motion
consciousness when blood has been poured out in any considerable
antity after injury to the cranium." (Cock.) They, are, however,
ly marked by the clinical history of the case, and can be generally
gnised.

The operation of trephining.

The instruments required for the operation are the *trephine*, or Instruments required.
ular hand-saw, of which there are two sizes; a *small saw*, with a
ight and circular edge, generally known as Hey's saw; a *sharp*
pel, with a handle rounded at the end to press back the periosteum
soft parts from the bone; a *flat probe*, thin enough to introduce
the groove made by the trephine, to guide the Surgeon in his
mpt to perforate the bone, and to prevent him going too far; a pair
tting forceps, to remove sharp points and edges of bone; *an*
ator, to raise depressed bone; and dissecting, dressing, and torsion
eps. (*Vide* Figs. 71A and B.)

The patient's head having been placed upon a pillow, *shaved* Position of patient.
ar as requisite, and held firmly, the first thing the Surgeon has to
s to expose the bone he wishes to perforate or elevate. This must
one freely, either by enlarging the wound that previously existed
y an incision crucial or otherwise. The soft parts should be divided Incision.
me cut down to the bone, and these, including the periosteum, should
ently pressed back with the handle of the knife. Bleeding at this
e should be arrested by ligatures, torsion, or the application of
ld sponge and pressure.

Supposing the case to be one of fracture with depression, and that Removal of fragments.

fragments of bone exist, they should be removed, great care being taken in their removal not to twist the broken bone, and thus run the risk of tearing the dura mater; and when an opening is thus formed, the depressed bone may be raised by means of the elevator carefully introduced beneath its free border. To facilitate this proceeding, perhaps the removal of a piece of projecting bone by forceps or Hey's saw will be found beneficial, and if so the trephine is not required; for the Surgeon's object, under the circumstances—to raise the depressed bone and remove the comminuted portions—may be completed without the trephine.

Application of trephine.

Should the bone be so depressed, however, as not to present an edge for the Surgeon's forceps, as is seen in the "gutter" fracture illustrated in Fig. 63, the trephine must be employed. The instrument should be previously prepared, the central pin being made to project sufficiently far to perforate the external table, and so fixed as to allow the saw to bite the bone. (Fig. 71A.) In a depressed fracture this pin *should never be placed upon the fractured*, but upon the border of the sound bone. The instrument is then to be applied, and the external table cautiously divided with a few semi-rotatory movements of the Surgeon's wrist. A groove having been made deep enough to allow the saw to work steadily, the instrument is to be removed and the central pin withdrawn and fixed (Fig. 71B), as it would be a fatal error to go on working with the pin projecting through the inner plate of bone into the dura mater. The Surgeon ought now to proceed with the utmost caution; and feel his way every few turns with the flat probe, for as soon as he has divided or even reached the inner plate the elevator may be employed and the loose ring of bone removed. When the inner plate is fractured to a greater extent than the outer, it may not be necessary to divide it, the removal of the external table with the diploë being sufficient to allow of the introduction of the elevator, and the removal of fragments.

Care in perforating inner table.

Should this not be the case, however, the inner table must be perforated, for the whole thickness of the bone must be removed. The operator cannot be too careful at this stage of the operation; and should always proceed with the conviction that the bone is thinner at one spot than another, and further, that "there is only the thinness of paper between eternity and his instrument." (Sir A. Cooper's MS. Lectures.) The depressed bone may then be raised by the elevator.

If the operation has been performed for extravasation of blood beneath the bone, and a clot be discovered, it should be removed; the utmost gentleness being used. Should pus exist, it will escape naturally.

After-hæmorrhage.

Should troublesome hæmorrhage from a meningeal artery ensue it may be arrested by tucking a small portion of sponge or carbolised catgut beneath the vessel and compressing it against the bone, or it may be held by a short pair of spring forceps against the bone. Free bleeding of this kind, however, is not frequent.

On puncturing the dura mater.

If, however, no blood or pus be found external to the dura mater, and strong evidence exist that it is placed beneath this membrane, the dura mater may be punctured. This step, however, is not to be undertaken without grave consideration. Yet, it may be asked, if the operation fail in its object, is the operator ever justified in making a second opening into the skull, in search of blood or of pus? Certainly it must be answered not at a hazard, although when there is evidence to

ject to a second position in which it is reasonably probable that the dividing fluid may be found, a second perforation may be performed; cases are on record in which three or more pieces have been removed with a good result. On making a second opening in the skull.

The wound, after the operation, must be treated on general principles; the edges of the soft parts being gently brought together, but not stitched; boracic acid lotion on absorbent cotton is the best dressing, and the head should be kept cool by the ice-bag. If the parts heal, and the case does well, a metallic shield may be required as a protection, although it is interesting to see how firm the membrane that fills in the cavity becomes after a time. After-treatment.

Should a hernia of the brain follow at a later stage, the same local treatment should be employed. Excision of the projecting fungous mass is a practice that is not advisable. The whole will probably wither by natural processes if a cure takes place, and the less the Surgeon interferes the better. Hernia cerebri.

General Conclusions on Injuries of the Head and their Treatment.

1. Injuries of the head are of importance only so far as they primarily or secondarily involve the cranial contents; a case of simple uncomplicated fracture of the skull being of less danger than one of general concussion of the brain.

2. A slight shaking of the brain, which manifests itself by a passing suspension of the cerebral functions, associated or not with a fracture of the vault or of the base of the skull, generally does well.

3. A severe concussion or shaking of the brain associated or not with a fracture of the vault or of the base of the skull, is probably associated with contusion or laceration of the brain substance, either upon its surface or within its ventricles, and consequently with more or less extravasation of blood; when the vessels are diseased, a copious hæmorrhage often follows a slight injury.

4. In cases of severe concussion, the brain is at least as much injured by *contre-coup* as it is at the seat of injury, its base suffering the most. Fracture by *contre-coup* does not take place.

5. A fall upon the vertex from a height, or a blow upon the head from a blunt instrument, may or may not be followed by fracture of the skull; but such an accident produces, as a rule, a general concussion of the brain, with contusion or laceration of its structure and effusion of blood either upon its surface or within its substance or ventricles.

6. Falls upon a pointed object, or blows with a sharp instrument, are, as a rule, followed by local fracture; and if the brain be injured, it is at the seat of injury. As a consequence, the symptoms may be accounted for by local causes only, and the surgical treatment should be directed by local considerations.

7. When symptoms of compression of the brain immediately follow an injury to the skull which has been produced by a fall from a height, or by a blow from a heavy and blunt instrument, the cerebral injury will be general, the brain will be contused and lacerated, particularly at the base, by *contre-coup*, and if extravasated blood be found external *to the dura mater, blood will also be found* upon the surface of the

brain, or within its membranes. The operation of trephining under these circumstances can be of no avail.

8. If symptoms of compression of the brain follow a local injury produced by a fall upon a sharp object, or a quick blow from a pointed one, such symptoms, as a rule, are produced by local causes, such as depressed bone, or extravasation of blood from a ruptured vessel, and such local injuries should be treated by the elevation of the depressed bone or by trephining.

9. When compression of the brain follows a local injury over the course of the meningeal artery, and the symptoms come on after reaction has been established, and the lapse of an interval of time from the receipt of the injury, the operation of trephining may be performed, although no depressed bone be present.

10. Encephalic *inflammation* may follow the slightest concussion or injury to the brain, whether complicated or not with fracture, and the danger of such a result is in proportion to the encephalic injury. In cases of contusion or laceration of the brain with extravasation of blood, inflammation is almost sure to occur, and, as a rule, will cause a fatal termination. This inflammation may appear within a few hours of the accident, or it may be postponed for days; it may be very rapid in its course, or very insidious in its nature. If the brain alone be affected, either a diffused or local abscess may result; while if the membranes are involved, effusions, convulsions, general or partial paralysis, coma, and death, will rapidly take place.

11. Fractures of the base of the skull may take place alone, and be marked by only special symptoms. They may be associated with, and are generally found in, all cases of severe fracture of the vault, when produced by a heavy fall or blow, the fissures radiating downwards in a direction parallel to the forces employed.

12. Fractures of the base may be complicated with encephalic injuries similar to those which complicate fractures of the vault, consequently they may be manifested by general as well as special symptoms; and in severe cases the former completely mask the latter.

13. All injuries to the head should be treated with extreme care and always regarded as serious. Rest in the horizontal posture, freedom from excitement, bland, nutritious, unstimulating food, being essentials under all circumstances; the great principles of practice consisting in warding off excess of reaction and inflammation of the cranial contents.

DISEASES OF THE SCALP AND CRANIUM.

Wens or sebaceous tumours of the scalp.

Besides the blood tumours of the scalp to which attention has been already directed, the head is very frequently the seat of the common skin or *sebaceous tumour* which is called a "wen," these morbid growths being more frequently found on the head than on any other part of the body. They are more common also in women than in men, seventy out of one hundred and seven consecutive cases of sebaceous cysts which I have analysed having occurred in women and eighty-four on the head. In many instances these wens are doubtless due to an obstruction of the duct of a sebaceous follicle, as the orifice of the duct is often visible, and through it the contents of the cyst can be squeezed; while in others no such obstruction can be made out, it being probable that some of these tumours are new formations—true adenoid tumours

of the skin; such tumours usually lying beneath the skin, but without any connection with it. These cases have, however, been fully considered at page 188.

Other tumours.

The scalp may likewise be the seat of other tumours, *simple* or *malignant*, of *epithelial* cancer of the skin, or of any other affection of the integument. These require no special attention here.

Nævi.

Nævi are very common in all their forms—cutaneous, subcutaneous, or mixed; but this subject will be considered in another chapter. Let me caution the student, however, not to adopt hastily any surgical proceedings with a nævus situated over a fontanelle, for although such may be dealt with with impunity I have known a fatal inflammation attack the membranes of the brain after the application of a ligature to an undoubtedly cutaneous nævus placed over this region. If possible he should wait till the bones have closed before he interferes.

Perforating tumours of the skull.

Perforating tumours of the skull occasionally come under the Surgeon's notice, and demand attention. The majority of them have their origin from the membranes covering the brain, and mainly from the dura mater. They are generally *cancerous*, and are often secondary deposits; though occasionally they seem to be of the "sarcomatous" nature. They were first described by Louis in 1744, under the term "fungus of the dura mater" ('Mém. de l'Acad. Roy. de Chir.,' tome v). Since his day all perforating tumours of the skull have been included under this heading. It must be remembered that a tumour growing within the skull, and pressing outwards, will cause absorption of the cranial bones, which fact is rendered familiar to pathologists by the enlargement of the Pacchionian bodies.

Symptoms.

The symptoms indicating the presence of this affection are very uncertain, although headache, more or less constant and severe, may exist with epileptiform convulsions and other brain symptoms; yet, as often as not, the first marked condition to which the patient's attention is directed is a swelling in one of the bones, the disease having progressed thus far without having given rise to any symptoms whatever. When the diseased mass has perforated the bone, the swelling, receiving its impulse from the brain, will be pulsatile, and this symptom is of importance, as a distinctive one between tumours of the bone itself and the perforating tumours of the membranes. In cancerous disease the bone itself will be infiltrated with cancerous elements and destroyed, while in benign tumours the bone will be absorbed simply by pressure, as is seen in aneurism. In the former case the opening in the bone will be ill-defined and irregular, and in the latter it will be smooth as well as regular.

Distinction between cranial and intracranial tumours.

Treatment.

With respect to treatment, it is almost needless to say that nothing can be done by way of removal of the growth. The symptoms to which it gives rise can only be relieved by sedatives, and life can only be prolonged, if at all, by general treatment.

The bones of the skull are liable to tumours, cancerous or benign, to exostoses, particularly of the ivory kind, and to myeloid growths; though in this place it is only necessary to mention the fact.

Meningocele and Encephalocele.

Meningocele and encephalocele.

These terms are applied to conditions of the head found in children at the time of birth, and infants thus affected are generally hydrocephalic. The words indicate a protrusion, a hernia, through the skull, either of the membranes of the brain or of the brain itself; the protrusion ap-

pearing as an elastic tumour in the line of one of the sutures. Such cases are always associated with some deficiency of the bones of the skull, it may be of some portion of the frontal bone, near the root of the nose (Fig. 72) or near its external angular process, and by far the most frequently of the occipital bone. In rare examples the deficiency may be at the base of the skull. Dr. Lichtenberg has recorded a case in the 'Transactions of the Pathological Society,' vol. xviii, in which the tumour was hanging out of the child's mouth, and communicating with the skull through an opening in front of the sella turcica.

Varieties.

In a *meningocele* the membranes may protrude as a whole; but sometimes the dura mater alone projects (*vide* Prep. 1563[60], Guy's Museum). In the true *encephalocele*, the brain itself is pressed out of the skull into the external tumour. This was well seen in a patient from whom the accompanying drawing (Fig. 73) was taken; the skull contained the anterior and part of the middle lobes of the brain, and the sac the remaining portions. The ventricles were likewise divided between the two. The posterior lobes were adherent to the membranes that formed the sac. In a *hydrencephalocele*, in addition to the brain substance, there will be a portion of one or both of the ventricles filled with fluid.

FIG. 72.



Meningocele at root of nose. (Mr. Poland's case.)

"An *encephalocele*," writes Sir P. Hewett ('St. George's Hosp. Rep.,' vol. vi), "is of a round or oval shape; in size it seldom exceeds that of a small orange; its attachment is broad; the integuments covering it present little or no alteration. In the earlier periods it has the characteristics of a watery

FIG. 73.



Meningocele.
(Drawing 501[30], Guy's Hosp. Mus.)

bag; but later on, as the fluid gradually disappears, the brain matter fills the sac, and then the tumour becomes soft and doughy."

A *hydrencephalocele* "in shape is more or less pyriform, with a marked contraction at its attachment, and sometimes a long and narrow stem; in size it is apt to become much larger than an encephalocele.

The integuments over it are thinner, fluctuation exists about the hernia, and large veins may be traced under the skin."

When these tumours are small and have a very minute communication with the cranial contents, they have been and may be again mistaken for some simple cyst or tumour. The Surgeon should therefore always suspect that a cystic tumour, situated over a fontanelle or suture, and particularly when over the nose, may have some communication with the membranes, and he should consequently postpone all operative interference till the diagnosis is clear. As the bones ossify, the opening between the tumour and the cranial contents may close. The cyst, if small, may then be excised; if large it may be injected with iodine, or Morton's iodo-glycerine solution. The utmost caution, however, must be employed in the treatment of these cases, and where uncertainty exists as to their true nature or attachments, the prudent Surgeon had better leave the case to nature than risk life by any hazardous enterprise.

May simulate a cystic tumour.

Natural cure.

Treatment.

Serous cysts simulating encephaloceles are met with. Billroth ('Clin. Surg.,' p. 43) and Atlee ('American Journ. of Med. Science,' Jan., 1883) have each recorded an example. Both were congenital and on the back of the head, with serous contents. In Billroth's case, when the child died, the cyst was found to consist of a thin wall with a very smooth lining. It lay in the cellular tissue beneath the scalp, and was entirely removable from the bone. Atlee's case was tapped, and two ounces of serous, not cerebrospinal, fluid were drawn off with success, and the sac subsequently withered.

Serous cysts.

Ostitis and periostitis of the bones of the cranium are common affections, and may occur either as a consequence of a local injury, of syphilis, of ostitis, or of other causes. They are also often associated with brain complications. Under the heading of traumatic encephalitis this subject was discussed, together with its treatment, and ostitis coming on from any cause other than injury presents very similar symptoms. I have seen in an infant periostitis the result of hereditary syphilis, and ostitis ending in necrosis. I have seen also half the frontal bone of a babe exfoliate after a punctured wound from a nail, without any brain symptoms. In the adult the complications attending inflammation of the bones, syphilitic or otherwise, are very variable.

Ostitis and periostitis.

The symptoms are generally local so long as the inflammation is confined to the periosteum covering in the bone, the chief being pain and tenderness, with local swelling; though when the inflammation has spread to the inner periosteum or dura mater, other symptoms appear, such as constant headache, and great irritability of brain; any worry or work increases pain, causes fever, restlessness, and want of sleep. As the disease progresses delirium, convulsions, paralysis, coma, and death may be the result.

Symptoms.

The inflammation in the bone may go on to suppuration, or necrosis; and the dead bone may exfoliate in masses (Fig. 74) or in small portions. Should no external outlet for the pus form or be made, either by natural processes or by the Surgeon, the retained pus within the skull may give rise to symptoms of compression of the brain, when it is probable that the brain itself and its serous membrane will become involved, and the case assume a most serious aspect. It is, consequently, a point of great importance for the Surgeon to anticipate such a complication, and, if possible, to prevent it.

May terminate in suppuration and necrosis.

Confined pus may cause compression.

Treatment of early symptoms.

TREATMENT.—When a patient has had a blow upon the head, and been either the subject of syphilis, or of chronic suppuration of the ear, and as an after symptom has a local swelling associated with pain of a constant and wearying character, the presence of a local ostitis should be suspected. When the swelling is tender to the touch and pain is aggravated by local pressure, this suspicion should be strengthened; and when these conditions are attended by pyrexia more or less severe, by sleeplessness, a quick irritable pulse, and a contracted pupil, inflammation of the bone, probably implicating the dura mater within and the periosteum without, may safely be diagnosed.

FIG 74.



Necrosis of frontal bone (from Emily S—, æt. 19). June, 1870.

Free incision.

Under these circumstances a free incision down to the bone should be made, since experience has proved that by the adoption of this practice, pain and other symptoms are, as a rule, relieved, and serious brain complications are often prevented. When external suppuration is present, and dead or dying bone is exposed, it is less common to meet with cerebral symptoms, since the pus finds its way externally through the wound, and there is consequently less irritation of and pressure on the dura mater, as well as less brain irritation. Should, however, brain complications appear, it is important to prevent their spreading for the Surgeon to interfere, as when confirmed brain symptoms have manifested themselves, the case is almost hopeless. The Surgeon, under these circumstances, should attempt to remove the necrosed bone, or perforate it by the trephine—both these operations having one common object, viz. to give free vent to the pus beneath the bone. Indeed trephining, under such circumstances, is not only a justifiable but a valuable operation, and, if performed with care, can do little harm. When operation is postponed till confirmed brain symptoms have appeared, there is too much reason to believe that irremediable changes have taken place, such as suppuration within the hemisphere or arachnitis, which no operation is likely to relieve; and yet "trephining" has been of use even in such cases when complicated with epileptiform convulsions. The Surgeon, however, should anticipate this stage of the disease when he can, and interfere before such symptoms appear; headache of a local and persistent character, associated with evident signs of local ostitis or necrosis, being always an indication of the propriety of trephining.

When external suppuration exists.

Removal of dead bone.

Trephining.

I need hardly add that constitutional treatment such as has been mentioned under the heading of "Encephalitis," and will be alluded to when the subject of syphilis is considered, ought to be carefully followed out.

M. Aran., 'Archives Générales de Médecine,' 1844.—*Cock*, 'Guy's Hosp. Reports,' 1842.—*Hewett*, 'System of Surgery,' by Holmes, 3rd Ed., 1883.—*Le Gros Clark*, 'Lectures at Royal College of Surgeons,' 1869.—*Pott*, 'Injuries of the Head,' 1768.—*Guthrie*, 'Commentaries in Surgery,' 1853.—*Erichsen's* 'Surgery,' 5th Ed., 1869.—*Hutchinson's* Prize Essay (Astley Cooper), 1865.—*Brodie*, 'Med.-Chir. Trans.,' vol. xiv.—*Wilks and Moxon's* 'Lectures on Pathology.'—*Callender*, 'St. Bartholomew's Hosp. Reports,' vols. i and iii.—*Hilton*, "Clinical Lectures," 'Lancet,' 1853.—*Nélaton*, Atlee's edition, 1855.—*Gama*, 'Traités des Plaies de Tête,' 1835.—*Adams*, 'Cooper's Surg. Dictionary,' 1861.—*J. Neudörfer*, M.D., Prague, 'Handbuch der Kriegschirurgie,' 1867.—*Pirogoff*, N. Leipzig, 1864.—Stromeyer's edition of *W. Mac Cormac's*, 'Notes of an Ambulance Surgeon,' 1871.—*West*, 'Med.-Chir. Trans.', 1880, vol. lxiii.

ON TRISMUS AND TETANUS.

Definition.

When a patient is the subject of an uncontrollable spasmodic contraction of the muscles of the lower jaw he is said to have "*trismus*" or lockjaw; and when the same condition attacks other or all the voluntary muscles of the body, he is said to have "*tetanus*." Tetanus includes trismus, and generally begins with it; though trismus may be a local affection. It is found in children as a result of dentition, and in adults, as a consequence of diseases involving the teeth, gums, or jaws. It is a spasmodic affection, produced by reflected irritation set up by a local disease, is rarely associated with any constitutional disturbance, and is, for the most part, cured on the removal of its cause.

Varieties.

Tetanus is likewise generally associated with some local source of irritation, some wound or injury; and is then called "*traumatic*." When no external or visible cause can be made out, it is denominated "*idiopathic*." When rapid in its course it is called "*acute*," when slow, "*chronic*." The acute form is usually the result of an accident, and generally fatal. The chronic is for the most part idiopathic, and more curable.

Infantile tetanus.

Tetanus is met with in new-born infants, and is then known as *trismus nascentium*, or *tetanus infantum*. It usually comes on the second week after birth, and may be so acute in its course as to destroy life in from ten to thirty hours; or life may be prolonged to eight or nine days. It is a common affection in the West Indies, and has been known to occur frequently in ill-ventilated lying-in hospitals. Bad ventilation consequently has been put down as one of its causes, the others being cold, exposure, internal irritation, and the division of the umbilical cord.

Predisposing causes.

Predisposing causes of tetanus.—Dismissing the last form of the disease from our consideration, it seems that tetanus may be found at any period of life, though more than half of the cases occur between ten and thirty years of age. The youngest case on record was in a child of twenty-two months, and the oldest in an adult of seventy-five years.

It is more than seven times as common in males as in females, and it is found in the healthy as frequently as in the cachectic, nor do the intemperate seem more prone to its attack than the temperate. It is, too, as frequent in the winter as in the summer months; though in warm climates the natives are more susceptible to its attacks than Europeans. Exposure to damp, cold, or sudden changes of temperature, have doubtless a powerful influence in exciting this disease, both

such an error. The peculiar restlessness of mind and body, the complete intervals of rest and absence of spasm, the peculiar aversion that is shown to fluid, accompanied by thirst, all symptoms characteristic of hydrophobia, are enough to distinguish between the two. Nevertheless, it should be remembered that Dr. J. W. Ogle, late of St. George's, has recorded a case of tetanus and hydrophobia combined.

'Brit. and For. Med. Rev.,' 1868.

Prognosis.

Prognosis.—In acute traumatic cases there are small hopes of recovery, while in chronic the chances are greater. The longer the patient lives the better seem the prospects of a good result; and, if ten days pass after the first appearance of the symptoms, and the disease is on the decline, the prognosis is favorable.

Taking all cases together, Poland gives one recovery to seven and a half deaths. More than half die within five days. The most rapid death has been in from four to five hours; and the longest duration of life on record in a fatal case, is thirty-nine days.

Mode of death.

How death is caused.—There can be little doubt that acute tetanus commonly destroys life by apnœa; spasm of the muscles of respiration and more particularly those of the larynx being the immediate cause. Poland tells us that this was the case in thirty-two out of forty-six cases at Guy's Hospital in which the mode of death was noticed.

In chronic tetanus, death is commonly caused by exhaustion. These facts have an important bearing on the treatment of the disease.

Pathology.

Pathology.—The late Mr. Wilkinson King, of Guy's, is stated by Poland to have been in the habit of remarking at the post-mortem table, whenever there was an examination of a case of death from tetanus, "Gentlemen, we will now proceed to give you a demonstration of a case of healthy anatomy, for there will be no visible morbid appearances otherwise than congestion of the organs in various degrees, owing to accidental circumstances." And at the present day these remarks hold good. It is true that Rokitansky, Demme, Lockhart Clarke, and Dickinson, have given us some descriptions of structural changes in the spinal cord which they have observed; and their observations moreover seem to coincide. These changes consist of disintegration and softening of a portion of the grey substance of the cord, which appears in certain parts to be almost diffluent. The semi-fluid substance thus formed, however, "is at first more or less granular, holding in suspension the fragments and particles of the disintegrated tissue, but in many places it is perfectly pellucid." Yet it is to be remembered that Billroth and other pathologists have failed to find these changes in the instances which they have examined, and it cannot therefore be accepted as certain, that these pathological conditions are constant in tetanus. There can be little doubt, however, that the nerves of the injured part are at times found inflamed and irritated, and from this fact the theory has been advanced, that through the injured nerves of the part the spinal centres become involved, and manifest these states of excitement through the motor nerves by producing muscular spasm; the disease being one essentially of the excito-motory system. Clarke believes "that the spasms of tetanus depend on the conjoined operation of two separate causes. First, that they depend on an abnormally excitable state of the grey nerve tissue of the cord induced by the hyperæmic and morbid state of its blood-vessels, with the exudations and disintegrations resulting therefrom. Second, that the

L. Clarke.

Nerves of injured part inflamed.

spasms depend on the persistent irritation of the peripheral nerves, by which the exalted excitability of the cord is aroused."

Treatment. TREATMENT.—Every imaginable form of treatment has been employed in this disease with success, to be discarded in its turn for something new. No settled form of practice can consequently be laid down. Still, much can be done in guiding the patient through this disease; in keeping him alive; and in warding off death.

Diet. To keep the patient alive the most careful attention to feeding is required; milk and concentrated liquid animal food being the best diet. If these can be taken in sufficient quantities, no other mode of administration is required; but if not, they must be given as enemata every four or six hours as the case demands. Stimulants must be used cautiously, though when the powers are failing they may be freely given.

Stimulants.

Quinine. Upon this principle of practice, quinine has been strongly recommended; it may be given in full doses to an adult, such as five grains every three or four hours, and then increased; or in one large dose, such as twenty grains, to be followed by the smaller one.

Calabar bean. Among specific remedies that have been greatly vaunted, the Calabar bean stands foremost, and may be trusted; it should be given in full doses, such as half a grain of the extract every two or three hours, or $\frac{1}{8}$th of a grain of its essential principle, eserine, increased to double, even the $\frac{1}{10}$th of a grain. Camphor also recommends itself to our notice in doses of from five to ten grains. The woorara poison has failed in its purpose. The bromide of ammonium or potassium has, however, been administered with advantage.

It was hoped that a valuable drug for this disease had been found in chloroform, but experience has not justified the expectation. The hydrate of chloral has now taken its place and been of some service. Demme has advocated with much success the use of the Curara, eight cases out of twenty-two having recovered under such treatment. In India the Indian hemp has been highly recommended. Nicotine and tobacco have also been successful. Aconite is another drug that offers some advantages, while opium has an unquestionable influence in allaying pain and mitigating the severity of the spasm. Ice, also, applied in bags along the spine, has apparently been of great value in the hands of American surgeons. The administration of remedies by subcutaneous injection, in these cases, promises to be a valuable adjunct to practice, enabling us rapidly to introduce into the system drugs that act antagonistically to tetanic spasm.

Curara.

Ice-bags to spine.

The patient should always be kept quiet, warm, and free from draught. He should, moreover, be so watched that in his spasms no injury can be sustained; attention should be paid to his bladder and bowels, for catheterism is sometimes called for; and purgatives and enemata to clear out the intestines are beneficial, although violent purgation cannot be advised.

Question of amputation. With respect to *local treatment* much may sometimes be done. In severe local injury when the nerves of the part are probably involved, amputation ought certainly to be performed; for a sufficient number of cases have been recorded in which success has followed the practice. In 1845 Mr. Key amputated a leg on account of tetanus, which had appeared six days after an unreduced dislocation of the astragalus; the symptoms disappeared at once after the operation. On dissecting

Case.

the foot the posterior tibial nerve was found to have been put violently on the stretch by the projecting astragalus.

In some cases, soothing applications, such as opium, may be applied to the wound, and in all, perfect cleanliness should be enforced.

One other means of cure remains to be noticed, which has reference to the mode of death in this disease. It has been shown that in the larger proportion of cases—in all the acute—death is caused by suffocation from spasm of the laryngeal muscles. It is also fairly recognised that this disease runs its course, and that the most our science can accomplish is to maintain life and ward off death. To this end the operation of tracheotomy seems to be of value, for with a tube in the trachea, death by laryngeal spasm cannot take place, and a better prospect of recovery is consequently given.

Tracheotomy.

I have employed this practice in one acute case, in which the Calabar bean was likewise given, and the patient sank from exhaustion, free from spasm; and there seems good reason to believe, that if I had performed the operation in the case I recorded in the early part of this chapter, life would have been saved. This matter, however, requires grave consideration, and the practice is not to be rashly followed.

Morgan, 'On Tetanus,' 1833.—*Curling*, 'On Tetanus.'—*Poland*, 'Guy's Hospital Reports,' 1857.—*Dr. Ogle*, 'Brit. and For. Med. Review,' 1868.—*Dr. Dickson*, 'Med.-Chir. Trans.,' vol. vii.—*Dr. L. Clarke*, Ibid., vol. xlviii.—*Dr. Dickinson*, Ibid., vol. li.—*Demme*, 'Schmidt's Jahrb.,' vol. 112.—*Thanhayn, O.*, Ibid.—'Year-Book,' Sydenham Society, 1862-64, &c.—"Puerperal Tetanus," 'Dublin Quart. Jour.,' 1865. 'Med. Times and Gaz.,' 1865.—*Billroth*, 'Pathol. Chirurg.,' 1868.

DELIRIUM TREMENS.

It often falls to the Surgeon to treat cases of pure delirium tremens uncomplicated with any surgical malady, and it is well, therefore, to refer to this subject by itself. There are other cases, perhaps, more aptly described by the term "*traumatic delirium*," in which the nervous symptoms are developed as a consequence of an injury received. In both classes the symptoms are essentially the same, and the treatment required is similar, still it is right to bear in mind the difference in causation, as in the one we have to deal with a nervous disease in an intemperate person, and in the other, with the same symptoms, as an incident in a surgical case. In simple delirium tremens, to use the familiar term, we have to deal with the case of a person who has indulged for an uncertain time in injurious doses of alcoholic liquors. It may be that a young man, after a prolonged debauch, has an attack of the "horrors," but the symptoms more frequently occur in those who have for a long period accustomed themselves to the excessive use of beer or spirits, even without amounting to drunkenness, and who at length are subjected to some shock or depressing influence. Inasmuch as the habits which have been mentioned as superinducing this disease are opposed to the simplest laws of health, it follows that they cannot be indulged in with impunity for long, and, consequently, we find the subjects of it, as a rule, of feeble powers of resistance, and often with diseased viscera. Such persons are bad subjects for any ailment, and it often happens that, when a person of this sort breaks his leg or meets with some injury requiring surgical treatment, he becomes the subject of delirium tre-

Traumatic delirium.

mens. Other causes are occasionally at work, such as starvation, mental anxiety, and the over-use of tobacco or opium.

Premonitory symptoms.

The disease is at times ushered in by certain premonitory symptoms, as patients who have once been the subject of an attack are sometimes conscious of the approach of another. A brewer who had been treated for this affection at Guy's some years ago, when he felt warnings of its advance on several occasions applied for admission, and, as a result, the attack was warded off.

Depression of mind and body are the chief premonitory symptoms, with restlessness and agitation, gloom, and foreboding of evil. Some slight febrile disturbance may also exist, but the one invariable and most important symptom is sleeplessness. The tongue is generally pale and flabby, as well as coated with a whitish fur, and is never dry. The appetite is bad, the breath often fœtid, and the bowels confined. The pulse may be quick, though soft and powerless. The skin is always moist and at times bathed in perspiration. With these symptoms the characteristic delirium with trembling is not far off. It may, however, in surgical practice set in suddenly without warning.

Its characteristics.

Delirium and tremor.

The nature of the delirium is very characteristic, and is always accompanied by allusions which are generally spectral. The patients see objects that do not exist, and hear sounds that are imaginary; these being always of a strange or frightful nature. At times some delusion as to business or home matters agitates the mind. These same unsound ideas are sometimes fixed during the whole attack; but more commonly succeed one another in rapid rotation. Sleeplessness under these circumstances is a constant accompaniment. The patient will be quiet for a time, muttering words without meaning, or, he will be restless and get out of bed in obedience to some imaginary call. He will pull about his bedclothes, will rise up in bed at one moment under one impression, and lie down again under another. If asked to put out his tongue he will do so, but probably with a jerk; if to give his hand, he will project it with a thrust. A nervous trembling of the extremities, with an utter want of control or steadiness of purpose is characteristic. If these symptoms continue, and rest cannot be obtained, prostration of all the powers will rapidly appear, and death will supervene from exhaustion or coma. If sleep—sound sleep—can be secured, the symptoms usually mitigate rapidly.

Want of sleep.

Prostration.

Prognosis.

The *prognosis* must depend on several considerations. If the patient be young and the attack ensue after a short period of drinking, the chances of recovery are hopeful, but if the attack occur in a man of middle age, habituated to over-drinking, and if his liver or kidneys be unsound, it is fraught with much greater danger. If the attack be associated, moreover, with an injury, such as a wound or fracture, another element of danger is introduced. The best guide to the patient's real condition is the study of the pulse, not merely as to the number of its beats, but with regard to its character. The sphygmograph is of great service in such cases, as by its help a "dicrotic" state of pulse is often shown where the finger would not indicate it, and such a condition is a bad omen. The most frequent complication is pneumonia, which often comes on rapidly and insidiously, and is a frequent cause of speedy death even when the excitement has subsided.

Treatment.

Treatment.—This disease essentially being one of depression of the

nervous system associated with sleeplessness, the main object of the Surgeon is to induce sleep, to calm the excited brain, and to give it time to recover its normal functions; and with this end absolute quiet and the use of bland and nutritious food are most essential.

Food. Easily digested, nutritious, food must be administered when it can be taken by the mouth, but when refused or rejected, resort must be had to enemata. Milk is, undoubtedly, the most suitable form of nourishment, either alone or mixed with eggs, but it does not suit all

Stimulants. stomachs. The question of giving stimulants, and to what extent, is one of great importance. As a rule, the less given the better, but in some cases it is advisable to give them, and that form of alcohol to which the patient has been accustomed is the best. Young men with an acute attack may do well without any, but in other cases, the feeble powers of the patient require some such aid to stand against the exhaustion caused by the restlessness and excitement. The chief reliance, however, should be placed on other forms of food, such as strong animal broths, Darby's fluid meat, or similar preparations.

Opiates. Opium, in one of its forms, is a drug still in flavour; although some reject its use altogether, and trust to feeding and time, relying upon the knowledge that the disease has a natural tendency to terminate in sleep after the second or third day. In an ordinary case of the disease, one grain may be given as a dose, or ℥xx of the tincture, repeated every three or four hours or oftener, till sleep is procured. In other cases two or three grains may be given at once, and followed by grain or half-grain doses.

The best method of administering drugs in this disease, however, is by subcutaneous injection, and I recommend the injection of morphia in solution in doses of a quarter or half a grain in preference to any other plan; because the condition of the stomach of patients suffering from the disease is far from satisfactory either for absorption or assimilation, and, by the hypodermic method of introducing the narcotic into the system, its absorption is more certain and rapid. In some cases the beneficial influence of morphia thus employed is very remarkable, and only in exceptional instances the treatment fails.

The use of chloroform has also been urged, though such a plan is not devoid of danger and can hardly be advised except for some temporary purpose, such as to dress a wound, or to enable an enema to be given.

Chloral. The hydrate of chloral is a drug of great value as possessing hypnotic qualities without the evils attendant on other drugs of this class. It may be given in doses of 20 or 40 grains, and repeated, at moderate intervals, till sleep is procured; when combined with ten-grain doses of the bromide of potassium it seems to be of more use. Drs. Kinnear and Lawson in the Melville Hospital have treated from 70 to 80 cases successfully with large doses of cayenne pepper, from 20 to 80 grains having been given as a dose. Dr. Maclean, of Netley, trusts to quiet and the use, at short intervals, of strong beef tea highly charged with cayenne pepper.

Digitalis. Of late years the value of digitalis has been greatly extolled, but my experience of it has not been favorable. It is given in large if not poisonous doses; such as two drachms of the tincture every hour for three or four doses till sleep is produced. It is a dangerous mode of treatment, and cannot be recommended.

When great excitement and some fever exist, antimony in small doses has been much advocated. The condition of the bowels almost always demands attention, as the tongue is usually foul and the secretions morbid. A purge sufficient to empty the colon is consequently of service, but violent purgation is injurious. Purgatives.

Tonics, such as quinine and iron, with or without opium, will be required as the disease subsides. The combination of the tincture of iron with the tincture of opium in carefully regulated doses is preferable. In other cases ammonia with bark may be administered. Tonics.

With respect to coercive measures in the treatment of these cases, there is no doubt that they ought to be condemned. In exceptional instances, where sufficient help cannot be obtained to prevent the patient from injuring himself or others, the jacket doubtless must be employed, but under no other circumstances is it justifiable. An attendant who combines decision of character and firmness, with a gentle and soothing manner, will almost always succeed in "influencing" the most troublesome patient. He is to *influence* him, however, and not to direct him; for contradiction and the exercise of authority over the subjects of this disease invariably excite opposition. Question of restraint.

There are some people who are never drunk, yet are always drinking; in whom the tissues are so weak that under injury they rapidly break up; and under disease show no power of repair. In such it is difficult to induce wounds to heal or show any vigorous action. Chronic intemperance.

The best remedy is to supply such patients with all sorts of nutritious food, to give tonics, and a moderate amount of stimulants, and thus endeavour to improve their habits as well as restore them to a more healthy tone.

SHOCK AND COLLAPSE.

A man receiving unexpectedly some startling news, which excites severe emotion, and dying suddenly, is said to die from shock; a second receives a fatal blow upon the epigastrium; a third is struck dead by lightning, death in each case is said to be due to shock. In all, the heart's action is suddenly arrested through the nerve centre—in one case through the mind, and in the others through the body. Under these circumstances, the heart is found full of blood, distension having paralysed its action. Shock.

A man receives a severe compound fracture, gunshot or other injury, and is not killed, but collapsed. Another, or possibly a child, is much burned or has a large portion of the integuments of a limb torn away or crushed, in which the peripheral nerves are seriously involved, and, as a result reflex paralysis of the heart occurs. Both have sustained a shock more or less intense, and, as a consequence, become cold and almost, if not quite, pulseless. In either case, the skin appears to be bloodless, and covered with a cold clammy sweat. He may breathe almost imperceptibly, feebly, or with sighs and gasps. His nostrils will, probably, be dilated; his eyes dull, with vision imperfect; and consciousness may be lost in very variable degrees,—the patient may possibly be roused, yet, as a rule, he requires rousing to prove the existence of consciousness. At other *times, the intellect remains quite clear.* Collapse.

Its signs.

These are briefly the signs of collapse, or shock, the result of injury. They are to be found in variable degrees after most accidents, and are by no means usually fatal, unless the injury itself is fatal. Of course, if the shock from the injury is very great, the heart may cease to beat and the lungs to breathe, collapse passing, more or less slowly, into death; but more usually, after a variable period, the heart's action gradually improves, the respiratory act becomes more regular, and perfect colour returns to the bloodless lips and skin, warmth re-appears on the surface of the body, and consciousness becomes more manifest; these symptoms indicate what is known as reaction, and, when they are excessive, febrile symptoms may appear. It should be noted, that vomiting is often the first indication of reaction in general collapse, as is it often in that of head injuries. Should the nature of the accident be such that hæmorrhage complicates the case, the collapse will be more lasting, the shock of the accident passing into collapse from hæmorrhage; under such circumstances a fatal result is very likely to ensue (the amount of bleeding and its rapidity determining the result), for it should be known, that hæmorrhage by itself is enough to produce collapse, or syncope, and this, added to the shock of the injury, is often more than enough to destroy life. In abdominal injuries, this combination is well seen, the hæmorrhage from a lacerated liver or other organ, as a rule, appearing with the first manifestations of reaction from the shock of the accident, and thereby proving fatal.

Reaction.

Delayed reaction.

The longer the reaction is delayed, the more grave is the aspect of the case; not unfrequently relapses appear, signs of reaction and of collapse alternating in variable degree, till one or the other asserts itself in recovery or in death.

Mania on reaction.

In rare cases, even from the shock of a slight accident, reaction is followed by exceptional symptoms; thus, I had a man under care who was admitted with a slight concussion of the brain, in whom reaction was attended with an acute attack of maniacal excitement which left him after two days to pass on to a steady convalescence. A woman with a similar injury attended with a scalp wound, had a like attack, which lasted a fortnight and then subsided without any bad results. I have recorded also, in another page, a case of general tetanic spasm which showed itself in the reaction after a case of spinal injury. More commonly, however, reaction is attended with what Travers has described as "prostration with excitement," a state bordering on, and often passing into, that known as delirium tremens.

Tetanus.

Conditions favorable to shock and collapse.

Under some conditions of the system shock and collapse are more readily produced than at others; thus, very young and very old subjects, those enfeebled from age or other cause, mental or physical, are particularly apt to die of shock, after injury or operation. When bones are involved in the injury and symptoms of "shock" appear after a day or two's satisfactory progress, Professor Nussbaum believes them to be due to fat embolism as evidenced by severe dyspnœa, œdema of lungs, and sudden death. Patients with bad kidneys, also, are very liable to suffer from shock, and to succumb to any operation, however trivial. Surgeons see this at times in the sinking after small operations. Thus, I lost some years ago, after the removal of a fatty tumour, a woman of middle age, simply from asthenia; the operation having been unattended by any loss of blood; also a child, æt. 8, after some operation on a cicatrix of the neck, in the same way. In both

Albuminuria and shock after operation.

bad kidneys were found after death. The idiosyncrasy of the individual has also a powerful influence on "shock."

Treatment. TREATMENT.—Shock or collapse uncomplicated with hæmorrhage may be treated in one way; shock or collapse, the consequence of, or combined with hæmorrhage, in another.

In both cases the heart's action must be either excited or maintained; "the heart must beat, and the patient must breathe," or life will fail. Even in the worst cases, as long as any signs of life exist, the respiratory process may be aided by artificial respiration, and the warmth of the body kept up by external applications. Savory, in an able article ('Holmes' System,' Ed. 2, vol. i), advises as the result of experiment and reasoning that, should no evidence of the heart's action be detected, and no hæmorrhage complicate the case, a vein should be opened—as the external jugular—in order that the over distended heart may resume its action as soon as it is relieved from its paralysis by distension.

Venesection.

Transfusion. In the extreme collapse following hæmorrhage transfusion is also "a fair and rational expedient."

In less severe examples the surgeon's object should be to keep the patient alive, but he ought not to try to do more; as to force nature is always injurious, and sometimes fatal. The failing powers of a feeble subject may be excited to act only to give way again, they may not a second time respond to the former stimulant.

A too rapid reaction may so stimulate the heart as to set up a fatal hæmorrhage, when by the collapse, the wounded artery might have become sealed by nature's own blood-clot.

In all cases of shock and collapse, therefore, complicated with local injury, great judgment is called for. To do enough to maintain life is essential, but to do more is injurious.

Posture. The horizontal position under all circumstances should be observed, External warmth. and external warmth secured by means of blankets, and hot flannels applied to the pit of the stomach. Sir J. Simpson's plan of applying heat to the body is very beneficial, by filling six or eight soda-water bottles with boiling water and tightly corking them, and then drawing over each a woollen stocking wrung out of hot water. The bottles so covered, are then to be packed around the patient in bed.

Stimulants. Stimulants in carefully adjusted quantities may be given, and brandy is the best. This should be given in small quantities, and if the heart's action fail to respond to its administration after two ounces or so have been swallowed, more is of little service, the stomach usually rejecting it. When the stomach rejects brandy, or the patient cannot swallow, an enema of brandy in warm starch, milk or gruel, sometimes acts very rapidly.

Food. As soon as the heart's action is established, liquid food, such as warm milk, may be given, though only in small quantities, and the case should be carefully watched; food and stimulants should be given with discretion and as the symptoms indicate, the greater the loss of blood the greater being the necessity for food.

Remedies for excessive reaction. Excess of reaction is to be checked by soothing remedies, opium in any of its forms, henbane, and chloral, are also very valuable, a few hours' calm sleep generally acting like a charm, yet when brain complication appears this treatment is to be adopted with care. Anything like coma contra-indicates it.

Amputation in collapse. In compound fractures and other local injuries demanding operation,

the question of operating on a patient in a state of shock is important. Can the operation act as a stimulant, and tend to rouse him? or may it act as a second shock, and tend the other way?

When the shock is severe, and the patient almost pulseless, it is doubtless the wiser plan to postpone all operative interference till the heart's action is re-established. To amputate a limb under extreme collapse is to destroy what chance of life exists, or to do an unnecessary operation. To amputate when reaction has set in after the lapse of a few hours, when external warmth, stimulants, and tonics have had their influence, is likely to prove successful.

When permissible.

In less severe examples of collapse, however, the same practice does not seem to be necessary, especially when hæmorrhage has been the partial cause, and is still continuing, because the loss of very little extra blood by oozing forbids, when collapse is present, any hope of a good reaction being established, and under such circumstances no benefit can be acquired by delay, but only harm. The administration of an anæsthetic has, moreover, a stimulating influence upon the heart and nervous system, which is often very valuable. I have frequently performed primary amputation upon subjects in a state of partial collapse after injury under these circumstances, and have never regretted it.

With a patient in a state of collapse no amputation should be performed, when, by delay, no harm can accrue. When hæmorrhage, however trivial, is going on, or is likely to recur at any moment, the Surgeon should interfere and remove the part when its removal is essential. When the collapse is associated with semi-consciousness, chloroform is not needed, the operation itself acting as a sufficient stimulant; but when the mind is clear as to what is going on, its use should not be withheld, because although it is true its secondary effects are sometimes depressing, and may be injurious, in a general way it has a beneficial influence, and tends to prevent a second shock, both mentally and physically.

When collapse is extreme.

When extreme collapse exists.

"How far," writes Savory, "the patient should be allowed to rally, and when he has reached that state which will enable him to bear the operation, are of course, questions which cannot be answered in a general manner, but which must be decided by the Surgeon in each case."

Rule.

Where the Surgeon is in doubt about acting, he had better decide in favour of delay. When no doubt exists as to the wisdom of removing an injured part, and by delay harm must or may probably ensue, he should act at once, even when the patient has not quite rallied from the shock of the injury. When, so far as the local injury is concerned, the delay of a few days or hours is unimportant, all operative interference should be postponed.

In severe compound fractures, gunshot or otherwise, hæmorrhage is almost sure to occur as soon as reaction appears, and the shock of the removal of a limb is not so much to be dreaded as the loss of blood.

Hammond. U.S.

"Wounds of the large arteries of the legs and arms from balls and shells always bleed more or less at the time of reception, and more freely as the shock to the nervous system passes off and reaction comes on. Even when this nervous shock is not sufficient to produce imme-

diate death, the chances of ultimate recovery must frequently turn on the mere question of loss of blood."

In military practice, primary amputation upon the field is now generally preferred to secondary, and, in civil practices a like rule should generally be enforced.

To perform any capital operation on a patient in a condition of extreme collapse or shock is bad practice. To do so, however, when a minor degree exists, and the pulse can be felt, when, by delay, other dangers, such as continued or renewed hæmorrhage are to be expected, is sound and good surgery. To an unconscious or only slightly conscious patient, an anæsthetic is not necessary. To the conscious it has often a beneficial action, and tends towards the encouragement of reaction. Summary.

FEIGNED AND HYSTERICAL OR MIMICKED DISEASE.

I have placed these two classes of cases together for purposes of convenience; and in this section, as they are essentially diseases of the nervous system. Both, in a measure, and with different degrees of accuracy, simulate real or organic disease. In feigned disease the will of the patient is strong to deceive, it is bent to simulate the symptoms of an affection of which the individual knows something, though not all, and from this, the full knowledge of the surgeon or physician is to override the imperfect knowledge of the impostor and expose him. In the hysterical the will of the patient is weak; functional derangement is allowed to assume the garb of organic disease; subjective symptoms are intensified, not, however, from motives of deception, but from a want of the controlling influence of health, more particularly of the nervous centres, a condition of hyperæsthesia commonly existing from some imperfect nutrition of the nervous centres. In exceptional cases anæsthesia is present, more particularly in the larynx. Feigned disease and hysteria contrasted.

Feigned disease is a voluntary deception from beginning to end, and is unreal. Hysterical disease is an involuntary exaggeration of some functional derangement, "an unwilling imitation of organic disease," and real.

Feigned affections are met with chiefly in the intellectually weak, or those of crafty character, and, in a general point of view are attended with an exaggeration of symptoms far beyond those met with in real or organic disease; pain is said to be far more intense than is usually met with, and paralysis more complete; every symptom simulated is extreme; inconsistencies are present which are not reconcilable with the symptoms usually met with in the disease simulated. These inconsistencies and exaggerations should always excite suspicion in the mind of the practitioner, causing him to test quietly every symptom or group of symptoms, and to doubt his diagnosis until he has proved its truth. General remarks on feigned disease.

To the *subjective* symptoms, or those complained of by the patient, these remarks are very applicable; but to the *objective*, or those palpable to the observer, they are so to a degree. The subjective symptoms are always exaggerated, the objective inconsistent; the former being too bad for truth, the latter inconsistent with experience. For example, the rigor of an ague may be simulated, while the hot and the sweating stage is impossible. Epileptic convulsions, catalepsy, or madness, Subjective symptoms. Objective.

may undoubtedly be imitated; but in all these there will be, when present, some exaggeration or inconsistency not found in the real disease. Nerve pains may be felt, but they will not follow any anatomical nerve distribution. Paralysis can also be readily simulated, but it will, probably, be too complete; it will, on testing, more particularly when done unexpectedly, be associated with a greater degree of sensibility in the skin than is usually present. When of long standing it will not be attended with the usual wasting. Vomiting, coughing, or spitting of blood can be artificially produced, though under these circumstances the severity of the symptom will, probably, contrast strangely with the mildness of any others with which it may be attended.

In fact, in feigned diseases, on a careful investigation into the history of the case, the succession of symptoms, their progress, intensity, and duration, some element will be brought out which is irreconcilable with truth, some suspicion that deception is at work will be excited, which, if worked out, must unmask the imposture and prevent error.

On hysteria. The subjects of *hysterical disease or of nervous mimicry* are mostly what are called nervous and emotional. They have commonly "a very Paget. unusual mental character: in the majority there is something, notably, good or bad, higher or lower, than the average—something outstanding or sunken." In this affection "every part of the body may become, under provocation, the seat of an apparent disease, that in Skey. reality does not exist, it may, and often does, assume all the attributes of reality with an exactness of imitation which nothing short of careful and accurate diagnosis can distinguish from the real disease." In joint and spinal disease, the truth of this is most frequently seen. Brodie having stated "that among the higher classes of society at least four fifths of the female patients who are commonly supposed to labour under diseases of the joints labour under hysteria."

Diagnosis. How, then, it may well be asked, is the hysterical affection to be made out from the real? How is the Surgeon to avoid falling into the error of treating some functional derangement as organic disease?

In a general sense, it may with truth be laid down, that in hysterical affection of a part, local pain and sensitiveness on manipulation, are always great, and bear no relation to the amount of change visible or to be detected in the part. The slightest touch excites pain, which probably a bold one fails to do; the pain too, rarely, if ever, follows the anatomical course of any nerve or nerves, and the onset of the symptoms is generally more sudden and severe than that usually ushering in organic affections. Febrile disturbance or increase of temperature, moreover, rarely complicates the case however severe the local symptoms may be, and the nervous "disturbance very rarely takes Paget. the form in which morbid nervous influence produces, not mimic, but real organic changes." In fact, all the subjective symptoms are much more severe than the objective, the latter being either very slightly marked or non-existing. For example, a girl is suddenly seized with severe and lasting pain in the hip, knee, or other joint, aggravated by movement or the slightest touch, and yet no visible alteration in its outline or structure can be detected, even after the lapse of many months. Another is as suddenly affected with spinal affection, as indicated by local pain in the back, inability to stand, &c. &c. with-

[illegible] evidence of organic disease. A third suddenly finds herself [illegible] to flex or extend a limb, and the slightest force excites severe [illegible] spasm and pain. A fourth is attacked without a cause, [illegible] some muscular spasm, possibly involving a finger or fingers—a [illegible] that resists all attempts at extension. A fifth suddenly loses [illegible] or the power of motion in some part of a limb, quite irre- [illegible] of nerve supply. In these cases, again, however severe the [illegible] may be during the day, it is rarely felt at night. Such patients, as [illegible], sleep well and quietly. During sleep, also, it often happens, [illegible] joints which are immovable by day are found to be more flexed or [illegible] extended. Patients with supposed diseased spine are found on their [illegible] coiled up in a natural attitude. As an aid to diagnosis, the value of some anæsthetic cannot be too highly praised; as with a patient [illegible] its influence, rigid parts rapidly yield, and rigidity of muscle [illegible] only with consciousness; parts supposed to be paralysed often [illegible], and suspected joint disease disappears by a close examination [illegible] previously doubt existed.

Value of Anæsthetics.

[illegible]terical disease is more commonly met with in female than in [illegible] subjects, in the single than in the married, in those whose nervous [illegible] have been unstrung from some mental or physical trial, or [illegible] the emotional centres are inadequately balanced by the higher [illegible]lling ganglia. It is characterised by the suddenness of its attack [illegible]e severity of all its subjective symptoms, neither the clinical [illegible] of the case nor the objective symptoms present being consis- [illegible]ith those usually met with in organic disease; the exaggeration [illegible]tain symptoms and the absence of others, coupled with the [illegible]lies of its nature, mark the hysterical affection over the [illegible]c, and are sufficient to excite a doubt as to the true nature of [illegible]fection.

[illegible] valuable information on this subject, the reader may be referred [illegible] lectures of Brodie, Skey, and Paget, Russell Reynolds' Essay on [illegible]ria, and Anstie's lectures in 'Lancet.'

CHAPTER VII.

INJURIES AND DISEASES OF THE SPINE, &c.

Spina bifida.

Description.

Spina bifida is essentially a congenital hernia of the membranes [illegible]e cord through an opening in the spine, due to deficiency, [illegible] arrest of development, of the neural arches of some of the bones [illegible]ng the spinal column. It is analogous to the meningoceles of [illegible]ranium which have been already described. It always contains [illegible]achnoid fluid, and often the spinal cord itself, or large nerve [illegible]a. Sir P. Hewett believes that when the fluid has collected in the [illegible]achnoid space, or between the cord and the membranes, the cord [illegible]ssed; and that when fluid alone is present, the collection is [illegible]ed in the cavity of *the arachnoid.* In the specimen figured on [illegible] *(Fig. 75), taken from a dissection* kindly made for me by Dr.

Pye-Smith, there was a funnelshaped opening, leading from tumour into the persistent central canal of the cord, the nerves spread out under the internal lining of the sac, and thus formin of the layers of its wall.

Characters of the tumour.

The spinal hernia is sometimes covered by the whole thickn integument; at others, the integument, though present, is very while occasionally the walls are represented only by a trans membrane. This last condition was present in ten out of twenty consecutive cases that have fallen under my care. The tumou have a broad base and free communication with the spinal canal narrow and more or less pedunculated one. Under the former ci

Fig. 75.



Dissection of spina bifida.

stances, the probabilites of the cord being directly involved are gr than under the latter. The tumour is always more or less glob tense, and elastic. When the child is asleep or quiet, the swelling be soft; but when the child cries, the tumour will rapidly fill The edges of the bony orifice are occasionally to be felt. The int

May ulcerate.

ment is, in some instances, ulcerated even at birth; while in o there will be a small opening in the walls, through which the s spinal fluid exudes.

mour is often associated with hydrocephalus, and in exceptional Associated with hydrocephalus.
is double (Fig. 76). A nævus is not seldom found situated
tumour. Such complications as club-foot or paralysis of the
abs, frequently coexist with it, and under such circumstances,
erably certain that the cord is included in the hernia; and
the nature of the deformity may have been determined by the
nerves which are involved. Paralytic symptoms are more Paralysis.
in the broad-based hernia than in the narrow. Incontinence
or of fæces may co-exist with the paralysis, or be independent

mbo-sacral portion of the column is more frequently affected Site of lesion.
y other; but the cervical, and dorsal portions are also liable
efect. Thus, in twenty-seven ex-
which came consecutively under
, thirteen occurred in the lumbar
our in the lumbo-sacral, and nine
acral. One was double, a small
being in the lumbar and a large
e sacral region (Fig. 76.) Twelve
cases were uncomplicated with
alysis or deformity. In eleven
s incontinence of urine and fæces,
d in four with paralysis of the
tremities. Four were complicated
drocephalus, two with nævus, and
h talipes. I have seen but two
s in which the tumour was in the
region. When the tumour is com-
with hydrocephalus, fluctuation
en be felt between the two parts,
on the head causing a fulness of
al hernia, and *vice versâ*. In excep-
ases, the spinal hernia may protrude
nterior part of the spine.

FIG. 76.



Double spina bifida, from Eliza F—, æt. 3 months.

osis.—In a general way there is no difficulty in diagnosing a Diagnosis.
ifida. In any infant a congenital tumour over the spine is
y a spina bifida; if globular and tense, or capable of becoming
hen the child cries, the probabilities are almost converted into
nty, inasmuch as the only cases for which this affection is liable
istaken are congenital tumours unconnected with the spine—
ibrous, fatty, or fœtal tumours. These may be hard and tense,
are rarely, if ever, made so much more tense from the child
s is the spinal hernia.

osis.—The majority of these cases prove fatal. Many of the Prognosis.
are ill-developed, and die within a few days of birth; death
nvulsions is very usual when the sac bursts and its fluid
escape, more particularly when the escape is rapid. The
of the sac is not, however, necessarily followed by this result.
watched a child with this affection for four years, in which
h the tumour was transparent and soon burst, and subse-
discharged at intervals for three years; it has now gradually
ed up into a solid mass. This case is an example of a natural Natural cure.
hich takes place by the gradual approximation of the bony

walls and closure of the orifice of the hernial sac. The more pedunculated the tumour, the better the prognosis, so long as no complication exists that threatens life.

Treatment. TREATMENT.—Palliative treatment is all that can be adopted in the majority, although in exceptional instances operative interference promises to be of service. The tumour must always be guarded from injury by some soft protective material, such as cotton wool or spongiopiline. Slight pressure sufficient to prevent rapid increase of the tumour is also beneficial, and the best method of applying it, is by a casing of gutta percha or felt moulded to the part. The application of collodion is sometimes useful.

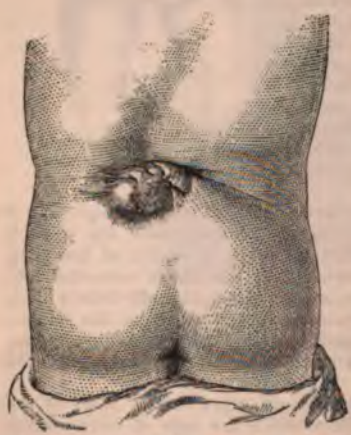
Palliative.

Tapping. Successful cases are recorded in which tapping of the hernia has been performed. The practice, however, is dangerous, as the drawing off of the fluid has been followed by convulsions and even death. Nevertheless, it is the least formidable form of practice that can be undertaken, and should always be employed before more active treatment is resorted to, if only as a preliminary measure. The puncture should always be made at the side of the tumour, for the cord when present is probably placed in the median line. The whole of the fluid should never be drawn off at once.

Not to draw off all fluid.

Case cured by tapping. Fig. 77 represents a case cured by puncture. It occurred in the person of a man, æt. 26, who came under my care at Guy's Hospital in 1874, for some ulceration of his left foot, which, with the left lower extremity, was wasted from infantile paralysis. He had also a lateral curvature of the spine towards the right side, and a cured spina bifida in the lumbar region. I discovered from the patient that he had been treated for the spina bifida by Mr. W. E. Image, of Bury St. Edmund's, who, in answer to a note, kindly sent me the following account of the case.

FIG. 77.



Cured spina bifida, taken from a man æt 26.

"The child was brought to me when about two years old, because the tumour was increasing in size, and convulsions were produced whenever any pressure was applied to the tumour, even from the weight of the body when placed in the supine position. The tumour was large and semi-transparent. I punctured it obliquely with a darning needle at intervals of two or three days, four or six times, and applied a compress of lint by means of strapping over the tumour. After this the fluid was not again secreted, the convulsions ceased, and the case got well." At the present time a hard puckered tumour alone exists to indicate the affection. A model of the case may now be found in Guy's Museum.

Dr. James Morton, of Glasgow, has advocated the injection, at intervals of seven or ten days, of half a drachm of a solution made by dissolving ten grains of iodine and thirty grains of iodide of potassium in an ounce of glycerine. The injection should be thrown into the sac after the withdrawal of some small portion of the spinal fluid. Dr. Morton reports ('Glasgow Med. Journ.' May, 1881) that out of twenty-nine cases operated upon there were but six failures. This success is encouraging. The operation, however, has its dangers. In a case of my own after the second tapping there was so much draining of the fluid from the cord, that the child died from exhaustion. After death there were no signs of inflammation of the membranes. Morton's Iodo-glycerine solution.

In no case where the base or neck of the tumour is large, nor in others in which it is evident the cord is implicated, or large nerve trunks are involved, should this or any other operation be performed. In pedunculated tumours it may be attempted. When unadvisable.

With respect to the *excision* of the tumour, a successful case has been recorded in the 'Path. Soc. Trans.,' vol. xiv, in which Dr. Wilson, of Clay Cross, removed the tumour five days after the closure of its neck by means of a clamp; and, when excision is entertained, this plan is probably the soundest. It should, however, only be thought of when the neck of the tumour is narrow, and there is no paralysis of the lower limbs or incontinence of fæces or urine. In all broad-based tumours associated with paralysis, operative measures are out of the question. Excision.

Exceptional cases of recovery are on record, after every form of practice, but, on the whole, the results of treatment are not very encouraging.

Sacral and Coccygeal Tumours.

Congenital tumours are by no means unfrequent in the neighbourhood of the coccyx or sacrum. They are sometimes composed of cysts, occasionally of fat or fibre tissue, and also of fœtal remains. They are generally central. Many of these have, doubtless, been described as false spinal bifida, and, in rare examples, there is reason to believe they are cured cases of spina bifida, the sac of the hernia having been occluded at its neck by the natural contraction of the surrounding parts. I have seen one such case in an adult where the tumour was successfully excised. Mr. Pollock has recorded in the eighth volume of the 'Path. Trans.' an example of a congenital fatty tumour which he successfully removed from the central lumbar region of a child æt. 7; and, Mr. Athol Johnson, in the same volume, a rare case of fatty tumour clearly developed in the spinal canal itself. I have had occasion to remove a large congenital sebaceous cyst placed between the anus and coccyx from a child æt. 10; and from another child, a tumour containing fœtal remains, situated between the sacrum and the bowel. I may further refer to a third interesting case of cystic tumour of the sacrum, possibly spina bifida, in which the cyst burst, and complete recovery followed. The following are the brief notes of the two latter cases. Characters. Their nature. Examples.

Marie B—, æt. seven weeks, was brought to me in 1868 with a congenital tumour the size of a large orange projecting from between the bowel and coccyx, and apparently passing up in front of the bone (Fig. 78). It had been growing rapidly since birth, and was pressing Notes of cases successfully treated.

upon the bowel, though the child in all other respects was healthy. I excised the growth, and found that microscopically it was made up of fat, fibro-cellular tissue, mucous membrane, cartilage, and bone elements. Recovery ensued and the child has kept well.

A male child, two days old, was brought to me on July 30th, 1868, with a large cystic tumour covering in the lower half of the sacrum and occupying the perinæum. It was the size of a cocoa nut, and

Fig. 78.



Fig. 79.



Congenital coccygeal tumours.

transparent as a spina bifida, yet in all other respects the child was well formed. The next day it burst and many ounces of a blood-stained fluid escaped. The sac collapsed, but no evil result followed this bursting of the cyst. I watched the child for many months, and, on November 30th, 1871, the tumour had contracted up to an irregular indurated mass of integument. The child was very healthy.

Treatment. TREATMENT.—The only effective treatment is the excision of the growth, which should be done, unless symptoms exist, such as extensive or dangerous connections of the tumour to contra-indicate the practice. Special care should be taken to ascertain that no communication exists between the tumour and the spinal canal.

Excision.

Fig. 79 represents a most interesting case, the particulars of which were kindly forwarded to me by Dr. Mercer Adams of Boston, Lincolnshire, who operated. The tumour was successfully removed from a female child æt. 10, and measured 22 inches in circumference, it was composed of cysts, and the largest, which was central, was lined with true skin covered with long silky hairs. This cyst contained thick putty-like material. From one of its walls grew an improperly developed fœtal leg and foot having three toes with perfect nails. There were also several curiously shaped fœtal bones scattered through the tumour—one like two coalesced ribs, and another a parietal bone. The tumour had deep pelvic attachments, and had to be dissected from the rectum. The lower part of the sacrum merged on the tumour.

Hewett, 'Med. Gaz.,' vol. xxxiv.—*Behrend*, 'Journ. f. Kinderkrankheiten,' vol. xxvi. —*Nélaton*, 'Path. Chir., vol. ii.—*Holmes*, 'Surgical Treatment of Children's Diseases,' 1869.

INJURIES OF THE SPINE, CONCUSSION, ETC.

General remarks.

The spine is a flexible tubular column composed of ring bones, alternating with a dense elastic intervertebral substance. These bones articulate by means of joints, and are bound together by strong yet elastic ligaments. From the upper orifice of the tube the spinal cord with its membranes is suspended in a chamber filled with cerebro-spinal fluid, and surrounded by large venous plexuses. The cord terminates opposite the second lumbar vertebra, but the membranes are continued down to the second piece of the sacrum. It is suspended in position by the nerve-trunks that pass with the processes of dura mater that accompany them outwards between the bones.

Local spinal injury.

A local injury to the spine, such as a forcible bend forwards, may sprain or lacerate the ligaments that hold the bones in position. A still more forcible bend may crush the bodies of the vertebræ that form the anterior portion of each ring. If the force be still continued upon the broken bones, displacement may take place, when the delicate cord itself will either be slightly pinched between the displaced bones and contused, or completely crushed or divided. In the cervical and lumbar regions—not in the dorsal—the bones may be dislocated, the amount of injury to the cord depending entirely upon the amount of displacement that has taken place. When such displacement is very slight, the cord may be uninjured. Sprains of the back may also, at a later period, be followed by disease both of the joints and bones of the spine.

Diffused injury.

A diffused injury to the spine, such as that caused by a fall from a height upon the back, or by a heavy falling body, may produce some fracture or dislocation of the bones of the spine, but it must to a certainty likewise cause a severe shaking, as from a railway accident, or a concussion of the spinal cord itself, as manifested by a more or less complete suspension of all the functions of the cord, either for a short period or for life. This concussion or shaking of the spine may be accompanied by hæmorrhage into or upon the cord, giving rise to compression, or may be followed by acute or chronic intra-spinal inflammation, terminating in paralysis and death.

Gravity of case dependent on amount of lesion to cord.

In *both local and diffused injuries of the spine the gravity of the case depends chiefly upon the amount of injury the cord has sustained;* a severe local injury to the osseous part of the spine can be completely repaired without danger to life, whilst any injury to the cord and its membranes is fraught with danger, either directly by suddenly arresting the functions of the parts to which the injured nerves are distributed, or, indirectly by setting up chronic inflammatory changes in the cord.

Concussion of spine.

When the functions of the cord have been directly suspended by any local or diffused injury to the spine, the patient is said to have suffered from *concussion of the spine.* Should the symptoms be complete and persistent, there is good reason to believe that the cord has been crushed by some displacement of a fractured or dislocated bone. Should some interval of time have taken place between the receipt of the accident and the paralysis, there is a fair suspicion that the paralysis is the result of some hæmorrhage into or around the cord. Should the paralytic symptoms have followed the accident after a few days, and be attended with constitutional disturbance or spasm of the muscles

Persistent paralysis.

of the limbs, the cause of the paralysis was probably some inflammation of the cord and its membranes; and should the paralysis have been of a slow and progressive nature, the probabilities are that it is the consequence of some chronic softening of the cord; because all these different results have followed local and diffused injuries to the spine; moreover, it is the knowledge that they may take place which renders any spinal injury a matter of importance, both as regards the immediate effects of the injury and its secondary consequences. I am bound however to add that Mr. Page in his recent interesting book on spinal injuries, "doubts whether any passing paralysis following a severe blow on the vertebral column, is not most likely to be due to the pressure of extravasated blood, which in course of time becomes absorbed," for he states that "we know of no case, nor can we discover the history of any where a transient paraplegia, or a suspension of the functions of the cord has followed a blow or fall upon the spine."

Page's views.

Tetanus after spinal concussion.

In rare instances, symptoms similar to tetanus follow spinal injury. I have seen such in two cases. One was that of a man, æt. 35, who fell from a height on his head, bending the neck forward. He was paralysed for a few hours from the neck downwards, and, on the appearance of reaction, had marked tetanic symptoms with the contracted brow and risus sardonicus. Spasms could be excited on the slightest touch being applied to his neck. In twelve hours, however, all these symptoms disappeared, and recovery ensued.

In the second case, a man received a crush in the loins, between two carts. Lock-jaw followed, with general spasms of all the muscles of the body. In five hours the spasms subsided, but they were followed for five days by hyperæsthesia of the integument, and, on the sixth day, by weakness of one leg. In a month he was convalescent.

Analogy between spinal and cerebral injuries.

In former chapters it was shown that the functions of the brain may for a time be interfered with or suspended by a simple shake or concussion of its substance; that a severe concussion may give rise to contusion of the brain, either at the seat of injury or on the opposite side by contre-coup; that extravasation of blood either upon the surface of the brain or within its structure may follow such an injury; that fractures of the skull are of importance in proportion to the severity of the intra-cranial complications; and that intra-cephalic inflammation is too frequently the result of any head injury. In injuries to the spinal column and its contents similar results have to be recorded. A *simple concussion* or shaking of the spine may produce a partial or complete suspension of the functions of the cord; yet by rest and quiet these symptoms may disappear, and a perfect recovery follow. A *more severe shaking* may give rise to some injury of the nervous structure; to some extravasation of blood upon or into the cord itself. Such a complication will necessarily be associated with more marked symptoms, more complete and persistent paralysis and anæsthesia of that portion of the body supplied with nerves from the injured centre; the completeness and persistency of the paralysis and anæsthesia depending upon the severity of the mischief, and, on the seat of injury. When the paralysis is severe but *incomplete*, there will be retention of urine, this symptom arising from loss of voluntary power over the muscles that regulate micturition. But, when the paralysis and anæsthesia are *complete*, there will be absolute paralysis of the bladder and all its muscles, with incontinence of urine. This incontinence, however, must

Simple concussion.

Severe concussion.

Complete or incomplete paralysis.

not be confused with the dribbling of an over-distended viscus from retention, the incontinence of retention of Gross, such as occasionally occurs in the less severe cases.

Symptoms according to regions injured.

When the injury is in the cervical region, one or both arms may be more or less paralysed; when in the lower dorsal, one or both legs; but, as a rule, the paralysis is symmetrical and the symptoms depend on the nerves that are involved. The loss of sensation is also generally complete. In one case, however, there may be paralysis of one limb and loss of sensation of the other; in a second, exalted sensibility with paralysis. In one, the power of motion may be regained, while that of sensation remains lost, and in another the reverse; indeed, on these points there is every possible variety, the seat of injury clearly determining the nature of the paralysis.

Brown-Séquard's observations on injuries to cord.

Brown-Séquard's observations and experiments on the decussation of the motor and sensory fibres of the cord, have done much towards the elucidation of these points, and it may now with some confidence be asserted, that when one antero-lateral column of the cord is divided or irreparably injured there must be motor paralysis of the same side of the body below the seat of injury, and loss of sensation upon the opposite side of the body—the motor paralysis being due to the destruction of the white substance, and the loss of sensation to that of the grey.

When any portion of the white substance is left intact, some motion will remain, and, when any part of the grey is uninjured, some sensation. Complete division of the cord is necessarily followed by complete paralysis and loss of sensation in the parts below, although, by what is called reflex action, the muscles of the parts may be made to contract on the application of any stimulant, such as tickling, to the sensory nerves.

Pain in the course of a sensory nerve, or in an extremity, is to be taken as representing the irritation of the cord or nerve at its central origin, and, in cases of fracture, as the spot where the bone has been broken. Symmetrical pains mean central mischief, unilateral pains local.

Cervical.

A severe blow upon the upper cervical region may produce, according to Erichsen, instantaneous death from concussion. When the *vagus* nerve is affected, a sense of suffocation, with irregular action of the heart, or constant vomiting, may be produced. When the *spinal accessory* is injured, spasm of the trapezius or sterno-mastoid muscles occur; and irritation of the *phrenic nerve* causes hiccup, as well as the sensation of an iron band-like constriction round the body. When the injury is in the lumbar region the paralysis is always partial, as the cord terminates at the second lumbar vertebra.

Lumbar.

Temperature of paralysed side.

The *temperature* of the paralysed limb is always lower than the rest of the body, even when to the patient it may feel hot or burning.

Prognosis.

The *prognosis* in any case of concussion of the spine depends entirely upon the changes that are produced in the cord by the injury; and these are fairly to be measured by the severity of the symptoms and their *persistency*. This latter guide is very reliable, the persistency of symptoms being generally indicative of organic change. Again, when organic change has taken place there is the greater probability of some secondary inflammatory action in the injured part, and on this the prospects of the case hinge; for in injuries to the spinal cord

Depends on persistence of symptoms.

or membranes, as in injuries to the brain, this intra-cephalic or intra-spinal inflammation is the cause of danger or of death in every case that survives the immediate effects of the accident, while it leaves, even when life is spared, more or less complete paralysis of the parts below the seat of injury.

INTRA-SPINAL INFLAMMATION.—SPINAL PARALYSIS AFTER CONCUSSION.—RAILWAY CONCUSSION.

General remarks.

INTRA-SPINAL INFLAMMATION.—"Every injury of the spine should be considered as deserving of minute attention. Inflammation of the cord and its membranes may supervene upon very slight injuries of the spine; it may advance in a very insidious manner, even after injuries that were of so slight a kind that they attracted at the time little or no attention." Thus wrote Abercombie in 1829, and his observations are as true now as they were then; indeed, it is upon such views that the whole treatment of injuries to the spine, simple or severe, ought always to be based.

The preventive treatment of spinal as of head injuries means the adoption of such measures as experience has proved are most valuable in warding off the accession of intra-spinal and intra-cephalic inflammation, and thus preventing paralysis. The simplest shock or concussion of the spinal cord; the slightest blow upon the spine or sprain of its ligaments; any bruising of the former or laceration of the latter; and, *à fortiori*, any severer lesion, is apt to be followed by an acute or chronic intra-spinal inflammation, and, by changes in the structure of the cord that may give rise to a paralysis, partial or complete. The surgeon has, moreover, no guide by which to measure the danger or calculate the probabilities of the occurrence of this secondary inflammation, since it may follow a slight accident, and fail to follow a severe one; at the same time the prospects of its appearance and its danger depend much upon the gravity of the injury.

Proneness to secondary inflammation of cord.

When the cord has been much contused or crushed by a fractured or dislocated vertebra, the paralysis that necessarily follows such a lesion is not likely to be aggravated by any secondary inflammatory changes in the injured cord, although the termination of the case may be hastened by these changes. Under such circumstances, the complication is not of such a nature as to add to the Surgeon's anxiety. In less severe examples of injury, however, in which the primary symptoms do not indicate any organic lesion beyond that which manifests its presence by some temporary suspension of the functions of the cord, it becomes a matter of primary importance to recognise the very earliest indication of inflammatory action, in order that it may be arrested; for, as it has been shown, that the chief aim in the treatment of all these injuries is, to prevent the occurrence of inflammation, so the second is, to try and arrest its progress as soon as it has appeared. When it has become thoroughly established, neither medical nor surgical art has much power in checking its progress or in correcting its effects; as the delicate structure of the spinal cord appears to be incapable of undergoing material repair when softened by disease or crushed by accident. The cord structure when once destroyed is

Necessity of recognising earlier symptoms.

replaced by means of a fibrous substance. Paralysis or loss of function, under these circumstances, is permanent. In any case, therefore, of spinal injury, when the symptoms are persistent or tend to become worse; when after their partial or complete disappearance for three or four or more days they recur or appear in some altered form; when local pain is increased, and movement of the back is more difficult or distressing; when pain follows the course of the nerve trunks that emanate from the injured spinal centre, and muscular spasm or paralysis is present; and, moreover, when constitutional disturbance or general febrility is present; when any or all of these symptoms, few or many, are found to follow a spinal injury after the first effects of the accident have passed away, the diagnosis of secondary inflammation of the cord may fairly be made, and action taken upon it. Symptoms of spinal inflammation.

In *general concussions of the spinal cord*, more particularly from railway accidents, when, owing to some general shaking of the body, the spinal, cerebral, sympathetic, and circulatory systems are all more or less involved, there is an undoubted disposition for a chronic inflammatory change of a most insidious and creeping kind to supervene. In some cases, however, the change is rapid, as in the case of a man æt. 46, who was admitted into Guy's with complete paralysis and loss of sensation of his body below the first rib, the result of a fall down twelve stairs the day previously. The day following his admission some slight feeling returned in his body, and a few days later he could move his legs. The paralysis, however, never left him, and he died on the 38th day of lung disease. After death, the spine was found uninjured, but the spinal cord opposite the sixth dorsal vertebra was soft and diffluent and contained granules. There was no trace of effused blood. Insidious nature of the symptoms. Acute case.

It is now well known that the primary spinal symptoms are often so mixed up with the general as to be masked, and, beyond a general but temporary loss of power and consciousness there is often nothing special by which spinal mischief is manifested. On recovering from the shock of the accident and the mental disturbance, the sufferer often feels no definite injury, no special local symptoms; and it may be that it is not till after some time has elapsed—the duration of which is also uncertain—that any special symptoms make their appearance. Symptoms often masked.

It will then probably be found that the patient has never been himself since the accident; he has been unable to work, mentally or physically, with the same force or energy that he did previously; is irritable in his manner, and perhaps feeble in his powers. Sleeplessness, too, has been more complete or common than it was before, and headache with general malaise, now often exists. Symptoms vague and indefinite.

Some slight unsteadiness of gait is often the first observed symptom, a feeling of heaviness in the limbs, some abnormal sensation, such as that of pins or needles, numbness along the course of a nerve, cramps, perhaps retention of urine; or some evidence, in fact, of want of control or power over the muscular apparatus, and more marked generally in the lower extremities than in the upper. The centres of sensation may, at the same time, show indications of disturbance, either by a state of lessened sensibility, or perhaps by a hyperæsthetic condition. From symptoms such as these the attention of the Surgeon is probably arrested. On testing the muscular apparatus thoroughly, it will probably be found that the patient will be unable to stand steadily on one leg, Premonitory symptoms. Affection of the muscular system.

or, what is a better test, if he place his heels together, he will totter on making the attempt to raise his body on his toes. When asked to stoop to pick up anything from the ground, he will probably bend his knees rather than his back; and walk with a rigid spine. On giving him a small object, such as a pin, he will take it clumsily and with tremor; will fumble at most things with his hands, and stumble at anything that is in his way.

Local signs.

On examining the spine some tenderness may be manifested on firm pressure, but probably only in certain places. Percussion on the bones is hardly a fair test; when employed, it should be indirect, through the fingers. Pressure applied to the spine causes at times severe pain, as does any movement; it is the latter condition which induces the rigidity of the spine in walking, before alluded to.

Cerebral signs.

The brain and organs of special sense may likewise be affected, either by over or under sensibility. *Vision* may be imperfect either in one or both eyes; *hearing* may be over-sensitive or defective; *taste* and *touch* may be perverted or lost; and *smell* at times destroyed or morbid. In fact, the whole nervous system, cerebral and spinal, may be disturbed, and its functions more or less damaged.

Progress uncertain.

The course which such cases run is very uncertain, and the prognosis is, therefore, difficult. When the motor power has been lost from spinal mischief, the best test is galvanism. A healthy muscle supplied from a healthy nerve centre will always contract on the application of the galvanic current. When the nerve centre is so diseased as to cause paralysis, the galvanic current produces no movement—no contraction. This test is beyond the patient's control, and cannot be resisted; it is consequently valuable.

Galvanic test.

Caution in interpreting symptoms.

In interpreting these symptoms, more particularly in a railway case, or in any where the question of damages is involved, it is most important for the Surgeon to separate the symptoms of which the patient complains—the *subjective*, from those he can himself perceive—the *objective*. Let him doubt and cross-examine in every way upon each of the former to test their accuracy. He may rely, however, upon the latter, and any positive opinion ought to be based upon these alone. There always hangs a suspicion over the former because self-interest points to making the worst of them.

Subjective and objective symptoms.

All the symptoms, taken as a whole, undoubtedly indicate a chronic or subacute inflammatory change of nerve-tissue, an inflammation of the membranes or of the cord. When they appear as a consequence of a general concussion of the spine, the cord is probably the seat of mischief, its delicate structure being more liable to injury than the tougher membranes, and, consequently, to secondary changes. When they follow some local injury, such as a twist, blow, or forcible bending of the back with laceration of ligaments, the disease in the cord probably is secondary to disease in the membranes, the inflammation of the latter being due to the extension of inflammatory action from the injured part inwards. "Inflammation of the membranes of the cord, as of the brain, is a disease not idiopathic, but proceeding from some cause without." But, whenever this commences it is progressive, and, in the end, involves all the tissues in its destructive changes.

Myelitis.

Spinal meningitis.

"Wilks."

Pathological changes.

The pathological changes themselves are tolerably definite. In the cord they put on the appearance of red softening in recent cases,

and of white in chronic. The parts are soft and pulpy, the microscope showing them to contain granule-corpuscles and elements of the inflammatory process. The white matter of the cord will appear at times sound, while the grey substance is soft. The disease may be local or more general. In concussion the latter is the more common condition. When it is in the cervical region, death is rapid, when in the lower dorsal, life may be prolonged for some time. This fact is well illustrated in fracture and dislocation of the spine.

Treatment. Importance of rest.

TREATMENT.—In all cases of concussion of the spinal cord, simple or severe, *absolute rest* in the horizontal posture is most essential, and, in mild cases, this is probably the only treatment called for; the symptoms, by the observance of this rule, gradually disappear, and the health is restored. The prone position in more severe cases is generally to be preferred to the supine, but the best guide in this matter is the ease which the patient experiences. The Surgeon, however, must enforce quiet for many days after the disappearance of all symptoms, even in the mildest cases, on account of the primary danger of intra-spinal inflammation; and the period of rest to be enforced must be in proportion to the severity of the symptoms. In cases of railway concussion, this practice is of primary importance, and I am disposed to attribute the frequent occurrence of obscure railway spinal cases to the non-observance of this rule. It is true that in the majority of cases there are no definite indications of spinal injury after the accident, though the nature of the accident itself is a sufficient guide to the case. A general shaking of the body means a general concussion of the spinal cord with every other part, and the nerve centres by reason of their structure are most liable to injury. It would be well, therefore, to keep all patients who have been the subjects of such injuries quiet and in repose for several weeks after the accident. By doing this much mischief would often be avoided.

Of prolonged rest.

Cupping, &c

After concussion, when severe local pain is experienced, relief is often given by the application of a dry cupping glass on either side of the painful part, and the operation may be repeated. In exceptional cases the local extraction of blood may be found of benefit. The application of cold is a powerful remedy for good when there is much effusion of blood or pain in the part, and when the symptoms of reaction are too marked.

The diet should be nutritious, but unstimulating, and nothing likely to keep up or cause mental or physical excitement allowed. When recovery of power in the limbs is slow, and no symptoms of secondary inflammation of the cord exist, convalescence is promoted by the application of electricity in one or other of its forms to the enfeebled muscles.

Mercury.

When symptoms of intra-spinal inflammation have appeared, some advocate moxas or setons in addition to the above treatment; and of the two the moxa is, perhaps, preferable. Mercury in one of its forms appears to be a valuable remedy, and the perchloride is, perhaps, the best preparation, given in doses of 1-16th of a grain two or three times a day combined with bark, quinine, or some other vegetable bitter according to the wants of the patient. When mercury is inapplicable the iodide of potassium should be substituted. Sedatives should be allowed to procure sleep, and the hydrate of chloral seems to be the best, in twenty or thirty grain doses, at bedtime.

Iodide of potassium.

Should pain be constant, fifteen grains of the same drug may be given twice a day, a double dose being allowed at night. The extract of belladonna in one third of a grain, or half-grain doses, is likewise a valuable sedative. Strychnine is a dangerous drug in spinal disease, at least, in progressive spinal disease. It is a distinct stimulant to the spinal centres, and is, consequently, most injurious as long as any progressive inflammatory action exists. When only the effects of the disease remain and all inflammation has ceased strychnine may be given. Should general feebleness exist, iron may be given with it, and I know of no nervine tonic so beneficial as the combination of the tincture of the perchloride of iron in doses of fifteen minims, with five minims of the tincture of nux vomica or one or two grains of quinine. Cod-liver oil is a valuable adjunct to all treatment in this as in many other cases.

Strychnine.

Iron.

Great care should be observed throughout the treatment of these affections to prevent the occurrence of bedsores. They form very rapidly when spinal paralysis is present. I have seen several instances in which all the soft parts over the bones sloughed, and the spinal canal was opened; while in others the sacral bone may partially exfoliate. The back should be kept very clean and dry and occasionally sponged with spirit lotion or spirits of camphor. It should also be protected further by leather strapping, felt plaster, and by cushions of air or water.

Avoid bedsores.

When retention of urine complicates the case, the utmost caution is required in passing the catheter. An elastic instrument should be preferred and of a large size, the French vulcanite catheter being the best. The catheter should be kept scrupulously clean.

FRACTURES AND DISLOCATIONS OF THE SPINE—WOUNDS AND SPRAINS.

In a practical point of view, it is expedient to consider fractures and dislocations of the spine together. They are not, however, invariably combined, for although in four fifths of the injuries to the spinal column involving the bones some fracture is present, in the remaining one fifth simple dislocation exists. The majority of these cases of pure dislocation occurs in the cervical region; in the dorsal, such an accident is almost impossible, while in the lumbar it is very rare. The difference in the anatomical arrangement of these divisions of the column affords an explanation of these facts. To the practical surgeon these points are, however, of small importance; that which concerns him the most in any injury to the spine has reference to the cord—how much injury has it sustained? Is it reparable or not?

Fractures and dislocations to be considered together.

Injury of the cord the main point.

When complete paralysis follows the injury there is little doubt that the cord has been injured. It may be that it has been more or less completely crushed or even divided by displaced bone. In less severe injuries, less severe symptoms show themselves. The nearer the injury is to the respiratory centre, the greater the danger; thus injuries of the cervical are more dangerous than those of the dorsal region, and these again than those of the lumbar. Any crushing of the cord above the third cervical vertebra, is, as a rule, followed by instant death; this point being above the origin of the chief respiratory nerve, the phrenic.

Symptoms, &c., vary according to region.

n cases of injury to the cervical vertebra giving rise to any symptoms f paralysis, death generally takes place within hree days, and commonly within two. Thus, ut of 36 fatal cases extracted for me by Mr. tendle from the Guy's Records, 25 died in less han seventy-two hours, and 20 in less than orty-eight; 8 only survived the former pe- iod, and in those there were no symptoms of aralysis as an immediate result of the accident. leven of the 36 were cases of pure disloca- on, 25 were examples of fracture and dislo- ation combined, and all were below the third ervical vertebra. In every case, also, of islocation, the upper vertebra was thrown orward upon the lower, as seen in Fig. 80. he reverse holds good only in exceptional ases as in the one illustrated by Fig. 81B, which a man, æt. 20, struck his head gainst the bottom of a bath when jumping r a dive a height of 12 feet. The drawing ows a displacement of the fifth cervical ertebra *backwards*, with a fracture of the urth and fifth and crushed cord. The an lived seventeen months.

Fig. 80.



Dislocation of the spine forwards, Guy's Hosp. Mus., No. 1033.

Fractures of the dorsal and lumbar ver- ebræ associated with displacement, and giving

Fig. 81A.



Fracture of spine and displacement of upper vertebra *forwards*. Guy's Hosp. Mus. No. 1035[a].

81B.



Fracture of spine and displacement of upper vertebra *backwards*. A, fifth; B, sixth vertebra.

rise to paralysis below the seat of injury, are less speedily fat
those of the cervical region.

Fracture of the spine may, however, take place and not be ass
with any paralysis. The spinous processes of any of the verteb
be fractured, and no spinal symptoms follow. This accident i
rally the result of a direct blow. When I was a dresser I saw
of fracture of the spinous processes of three cervical vertebr
ciated with a temporary paralysis, and in this instance complete r
ensued; I have since treated successfully a case of fracture a
placement of the spinous process of the fourth cervical vertebra
paralysis.

May escape detection.

In other cases, fracture of the spine may take place and
detected until after death. Thus, in 1879, a man æt. 23, was ad
into Guy's Hospital, under Dr. Wilks, for some throat af

Case.

as suggested by difficulty in swallowing and inflammation
soft palate with a sloughy patch of tissue in the pharynx.
symptoms had come on after a fall of 10 feet down a ship
three days previously. There were no symptoms of paralysis
man died on the fifth day of his admission and eighth day af
accident with dysphagia as his most prominent symptom, ass
with febrile disturbance and delirium with tremor. After dea
body of the fifth cervical vertebra was found fractured, and its
fragment projecting forward. The cord was not affected. Ther
sloughing prevertebral abscess communicating with the phar
wound which had been clearly caused by the fractured fifth ve
A portion of the laminæ of the fifth vertebra was necrosed and
with putrid pus which had spread upwards to the base of the

Example.

and caused death. In 1857, a woman, in an attack of man
admitted into Guy's under the care of Mr. Cock, for some co
of the back caused by a fall out of a window. Beyond the
sion, no injury could be made out. There was no paralysis, b
the contrary, violent muscular movement. On one occasi
patient got out of bed and struggled to open a window to throw
out. She lived sixteen days, and during the last week of life
quietly in bed, with her eyes closed. She would only at times
herself and speak. After death, atrophy of the brain was foun
general fatty degeneration of the viscera. The last dorsal an
upper lumbar vertebræ were fractured through their bodies, b
displaced; one or two spinous processes were also fractured.
spinal marrow was uninjured. The fact of there being no di
ment of the broken bones, and no injury to the cord, preve
correct diagnosis being made.

I have seen also a case of fracture of the spinous processes
last dorsal and the first lumbar vertebræ with lateral displac
the injury having been treated for some months previously, as a
contusion of the back. In this case no paralysis existed or other
symptoms.

Generally the result of indirect forces.

Fractures and dislocations of the spine are generally the re
indirect forces, such as severe falls. A forcible bending forward
cervical spine may cause dislocation of the cervical vertebra
a similar accident to the dorsal spine may cause fracture. In
cases, too, there is always some laceration of the ligament
crushing of the anterior edges of the bodies of the vertebræ.

Fig. 81A.) A forcible bending backward of the spine may produce a like result, the laminæ of the dorsal or lumbar vertebræ, under these circumstances, being much broken. Direct violence to the cervical region of the spine may produce dislocation; whilst to the lower vertebræ it generally causes fracture of the spinous processes or laminæ. Mr. Holmes has recorded, in the 'Path. Soc. Trans.,' vol. x, an interesting case of displacement of the last dorsal from the first lumbar vertebra, associated with some slight fracture of the processes, the result of a direct blow.

Complicated with fracture of sternum.

Fracture of the sternum is not uncommonly associated with injuries to the spine from the forcible bending forward of the head. It was found in four out of fifty-six fatal cases that occurred at Guy's.

Statistics of 56 cases.

Of these fifty-six fatal cases of fracture and dislocation of the spine, thirty-six were of the cervical region, eleven being examples of pure dislocation, eighteen of the dorsal, and two of the lumbar; injuries of the cervical being apparently twice as frequent as those of the dorsal region; the greater mobility of the cervical vertebræ and the obliquely horizontal aspect of their articular processes favouring dislocation.

36 cervical.

In the thirty-six cervical, the injury was below the third vertebra in all but three examples. In one of these it involved the second, third, and fourth vertebræ; in another, the arch of the atlas and spinous processes of the second and third vertebræ; and, in the third case, the bodies and arches of the third, fourth, and fifth vertebræ.

18 dorsal.

In the eighteen dorsal, seven were in the upper and eleven in the lower half, the lower part of the cervical and of the dorsal regions being clearly more liable to injury than the upper.

When the cord was sufficiently injured in the cases of injury to the cervical region to give rise to paralysis, death generally took place within three days, and, in the majority of instances, within two.

When it occurred as a result of injury to the dorsal region, suppuration of the kidneys, cystitis, or bedsores were the most common causes of death.

11 cases of pure dislocation of cervical.

Of the eleven cases of pure dislocation of the cervical vertebræ, four were between the fourth and fifth; two between the fifth and sixth; three between the sixth and seventh; and two between the seventh cervical and the first dorsal. In none of these was there the smallest trace of fracture. In six, the displacement was so great as to crush the cord. In five, there was no displacement and no marked paralysis as a direct result of the injury, although secondary paralysis appeared subsequently, from stretching or other injury to the cord.

In injuries to the cervical region, pure dislocation occurs in thirty per cent. of the cases.

Dislocation of upper cervical.

Cases of sudden death after a fall from a height upon the vertex are, doubtless, often due to a fracture or dislocation of the cervical spine. It may be a fracture of the processus dentatus of the axis; a laceration of the transverse ligament binding it in position; or a fracture of the atlas allowing the head to slip forward. Dislocation of the occipital bone from the atlas has been described; it is, however, very rare.

Fracture of odontoid process.

When fracture of the odontoid process takes place, as it may from external violence, or during the progress of some disease in the vertebræ,

death, as a rule, occurs suddenly; the victim being literally pithed. In other cases, and these generally of disease, the displacement may be gradual; death being then often preceded by paralysis of an arm or leg or both, with difficulty in swallowing, pain in the neck, and inability to raise the head into the erect position, or to rotate it.

Vide paper on fractures of the odontoid process, by Dr. Stephen Smith, of New York ('American Journal of Med. Sci.,' October 1871).

Diagnosis. **Diagnosis.**—When a patient has received a severe injury to the spinal column followed by *complete* paralysis, the cord has been injured, and it is probable that a fracture or dislocation with displacement of the vertebræ has taken place. When the paralysis is *partial*, it is probable that the cord has been only partially involved, but more or less bruised, or stretched, according to the nature of the accident, and the extent of the displacement of the injured bones. When no paralysis is present the diagnosis of fracture or dislocation is difficult.

When any inequality or irregularity in the spinous processes is present; any pain in one spot aggravated by pressure; any crepitus on manipulation: any local effusion of blood about the spine; any inability to move the spine or support the body; when priapism appears early in the case; when one or more or all of these symptoms come on after such an accident as is liable to produce them, the diagnosis of fracture or dislocation is tolerably clear.

When paralysis of an arm or leg follows a spinal injury, it is possible that the paralysis may be caused by pressure upon one or more of the nerves that pass outward from the spine, or by laceration of the nerve trunk from some partial displacement of the injured bone. When the paralysis is incomplete, the motor power is generally more completely lost than that of sensation; indeed, it often happens that there is hyperæsthesia in that portion of the body contiguous to the paralysed part, owing to the portion of cord above the injury being over-excited or irritated by the sharp parts of the fractured bone. Intense pain at the line of junction of the paralysed and non-paralysed parts sinks in fracture, in Mr. Erichsen's opinion. In estimating the seat of injury from the position of the paralysis, it is right to remember that the nerves come off obliquely from the spinal cord and pass downwards to the cervical and dorsal nerve trunks leaving the spine one or more vertebræ lower than the spot whence they are given off; while the cord terminates at the second lumbar vertebra. Thus, when fracture takes place below the second lumbar vertebra, the patient may be unable to stand or walk wholly or in part, yet there may be no paralysis for place him on his back and there will be free movement of his legs. In other cases, the nerve trunks around the cauda equina may be involved.

Increase of temperature. When a patient has received a severe spinal injury, there may not occur what is called "shock;" but when these symptoms have passed off and those of reaction appear, there will commonly—in cervical injuries—exist some throbbing of the arteries and increase of the temperature of the paralysed parts. These conditions are due to paralysis of the arteries as a result of injury to their vaso-motor nerves. At a later period, however, this increase of temperature subsides and a diminution can be detected. In exceptional cases the vaso-motor paralysis is associated with coldness of the parts, and it is very

his coldness exists, it is due to great depression of the
.

e a common consequence of spinal injuries, and more parti- Priapism.
rvical and upper dorsal. It may occur, however, in lower
in the lumbar. I have recorded an example occurring in
sal ('Path. Soc. Trans.,' vol. vii, p. 332).

—The nearer the injury is to the respiratory centre the Prognosis in cervical injuries.
danger to life. Thus, in injuries to the cervical spine
gin of the phrenic nerve or third cervical vertebra causing
th may be instantaneous; when below this position, and
ry process is maintained only through the diaphragm,
prolonged beyond the third day, and, as a rule, not beyond
Exceptions to this rule however are met with. Mr. Hilton
in his lectures 'On Rest' a case in which a man lived for
s completely paralysed from the neck downwards, after a
e cervical vertebræ; and in my own practice I had a case
of a gentleman, aged twenty-nine, whom I saw with Mr.
outhgate, November 25th, 1870, with complete paralysis
body below the fifth cervical vertebra, caused by a fall
k; he lived nearly ten years, and died from lung disease,
ely by the diaphragm.

cord has been injured in the lower dorsal or lumbar region In dorsal or lumbar injuries.
prolonged for many months, the immediate cause of death
ally some renal or vesical mischief, some bedsore or other
, the direct result of loss of nerve power in the paralysed
longer these complications are delayed by careful nursing
, the longer can life be maintained.

ases, again, in which only partial or no paralysis at all
a direct consequence of the injury, inflammatory changes
the injured part, and, spreading upwards, cause death.
s in such instances will be mainly determined by the seat
, and the extent of the mischief in the cord.

the seat of injury, the better the prospects of a cure; Rules as to prognosis.
the cord is involved in the mischief, the greater the chances
r.

ures of the lumbar region are quite capable of a complete
ctures of the lower dorsal vertebræ are not unfrequently
m. Injuries to the cervical part of the spine are gene-
ithin three days. Injuries to the dorsal, when not proving
the third week, may be survived for months, and even years,
of life being greatly determined by the warding off of the
mplications which so frequently arise.

T.—The diagnosis of a fracture or dislocation of the Care in manipulation.
been made, the most essential point to attend to is, to
t absolutely unmoved. The patient should be examined
eatest care, and moved with every possible precaution,
n may add to the injury the cord has sustained, and in-
nger to the patient. Extension of the spine may be em- Extension in exceptional cases, good.
much deformity exists, and particularly when severe pain
erve pressure, but extreme caution is required in following
; it is not to be employed in every instance, but only when
ns seem to *suggest the probabilities* of a reduction of the
displaced bone, or the relief of pain. I have known

death, as a rule, occurs suddenly; the victim being literally pithed. In other cases, and these generally of disease, the displacement may be gradual; death being then often preceded by paralysis of an arm or leg, or both, with difficulty in swallowing, pain in the neck, and inability to raise the head into the erect position, or to rotate it.

Vide paper on fractures of the odontoid process, by Dr. Stephen Smith, of New York ('American Journal of Med. Sci.,' October, 1871).

Diagnosis.

Diagnosis.—When a patient has received a severe injury to the spinal column followed by *complete* paralysis, the cord has been injured, and it is probable that a fracture or dislocation with displacement of the vertebræ has taken place. When the paralysis is *partial*, it is probable that the cord has been only partially involved, but more or less bruised, or stretched, according to the nature of the accident, and the extent of the displacement of the injured bones. When no paralysis is present the diagnosis of fracture or dislocation is difficult.

When any inequality or irregularity in the spinous processes is present; any pain in one spot aggravated by pressure; any crepitus on manipulation: any local effusion of blood about the spine; any inability to move the spine or support the body; when priapism appears early in the case; when one or more or all of these symptoms come on after such an accident as is liable to produce them, the diagnosis of a fracture or dislocation is tolerably clear.

When paralysis of an arm or leg follows a spinal injury, it is possible that the paralysis may be caused by pressure upon one or more of the nerves that pass outward from the spine, or by laceration of a nerve trunk from some partial displacement of the injured bone. When paralysis is incomplete, the motor power is generally more completely lost than that of sensation; indeed, it often happens that there is hyperæsthesia in that portion of the body contiguous to the paralysed part, owing to the portion of cord above the injury being over-active or irritated by the sharp parts of the fractured bone. Intense pain in the line of junction of the paralysed and non-paralysed parts signifies fracture, in Mr. Erichsen's opinion. In estimating the seat of injury from the position of the paralysis, it is right to remember that the nerves come off obliquely from the spinal cord and pass downwards, the cervical and dorsal nerve trunks leaving the spine one or two vertebræ lower than the spot whence they are given off; while the cord terminates at the second lumbar vertebra. Thus, when fracture takes place below the second lumbar vertebra, the patient may be unable to stand or walk wholly or in part, yet there may be no paralysis for place him on his back and there will be free movement of his legs. In other cases, the nerve trunks around the cauda equina may be involved.

Increase of temperature.

When a patient has received a severe spinal injury, there may or may not occur what is called "shock;" but when these symptoms have passed off and those of reaction appear, there will commonly—in cervical injuries—exist some throbbing of the arteries and increase of the temperature of the paralysed parts. These conditions are due to paralysis of the arteries as a result of injury to their vaso-motor nerves. At a later period, however, this increase of temperature subsides, and a diminution can be detected. In exceptional cases the vaso-motor paralysis is associated with coldness of the parts, and it is probable

at, when this coldness exists, it is due to great depression of the eart's action.

Priapism is a common consequence of spinal injuries, and more parti- Priapism.
larly of cervical and upper dorsal. It may occur, however, in lower orsal, not so in the lumbar. I have recorded an example occurring in e lower dorsal ('Path. Soc. Trans.,' vol. vii, p. 332).

Prognosis.—The nearer the injury is to the respiratory centre the Prognosis in cervical injuries.
reater the danger to life. Thus, in injuries to the cervical spine bove the origin of the phrenic nerve or third cervical vertebra causing aralysis, death may be instantaneous; when below this position, and e respiratory process is maintained only through the diaphragm, fe is rarely prolonged beyond the third day, and, as a rule, not beyond e second. Exceptions to this rule however are met with. Mr. Hilton as recorded in his lectures 'On Rest' a case in which a man lived for ourteen years completely paralysed from the neck downwards, after a acture of the cervical vertebræ; and in my own practice I had a case the person of a gentleman, aged twenty-nine, whom I saw with Mr. oberts, of Southgate, November 25th, 1870, with complete paralysis the whole body below the fifth cervical vertebra, caused by a fall pon the neck; he lived nearly ten years, and died from lung disease, reathing solely by the diaphragm.

When the cord has been injured in the lower dorsal or lumbar region In dorsal or lumbar injuries.
fe may be prolonged for many months, the immediate cause of death ing generally some renal or vesical mischief, some bedsore or other mplication, the direct result of loss of nerve power in the paralysed arts. The longer these complications are delayed by careful nursing d attention, the longer can life be maintained.

In other cases, again, in which only partial or no paralysis at all present as a direct consequence of the injury, inflammatory changes ay ensue in the injured part, and, spreading upwards, cause death. he prognosis in such instances will be mainly determined by the seat the injury, and the extent of the mischief in the cord.

The lower the seat of injury, the better the prospects of a cure; Rules as to prognosis.
nd the less the cord is involved in the mischief, the greater the chances a recovery.

Thus fractures of the lumbar region are quite capable of a complete re, and fractures of the lower dorsal vertebræ are not unfrequently covered from. Injuries to the cervical part of the spine are gene- lly fatal within three days. Injuries to the dorsal, when not proving tal within the third week, may be survived for months, and even years, e duration of life being greatly determined by the warding off of the condary complications which so frequently arise.

Treatment.—The diagnosis of a fracture or dislocation of the Care in manipulation.
pine having been made, the most essential point to attend to is, to ep the part absolutely unmoved. The patient should be examined ith the greatest care, and moved with every possible precaution, any motion may add to the injury the cord has sustained, and in- ease the danger to the patient. Extension of the spine may be em- Extension in exceptional cases, good.
loyed when much deformity exists, and particularly when severe pain ises from nerve pressure, but extreme caution is required in following is practice; it is not to be employed in every instance, but only when cal symptoms seem to suggest the probabilities of a reduction of the islocated or displaced bone, or the relief of pain. I have known

cases in which a successful reduction of displaced bone has been effected by extension, and seen others in which marked relief was afforded by this course. Practised with discretion, extension of the spine is doubtless a valuable means of treatment. A good example of this occurred in the practice of my colleague, Mr. Davies-Colley, on March 14th, 1883, when a man, æt. 56, was brought into Guy's after having been doubled up forwards, with projection of the first lumbar vertebra, three quarters of an inch behind the level of the last dorsal, and some paralysis of motion and sensation of the right lower extremity. Under chloroform powerful traction was made upon the legs by assistants, and Mr. Davies-Colley, whose hand was placed upon the projecting bone, felt it gradually sink to the level of the upper vertebra; at the same time crepitation and mobility were felt, as if the bone immediately above had been broken. A plaster-of-Paris jacket was then applied. For ten days the urine had to be drawn off. At the end of a month sensation had returned in the right leg, but the foot was in the position of talipes valgus from paralysis of the peronei muscles. The jacket was removed, and no deformity existed. The man could move in bed without pain. He left the hospital cured, but with the talipes.

Example.

When the injury is in the mid or lower dorsal region the application of a plaster or other jacket, with the patient in a horizontal position, gives comfort by ensuring immobility, and helps recovery.

When the patient is placed on his back the parts have a natural disposition to fall into place; this position, therefore, must be maintained. The bed should be firm, yet elastic; and a water bed is the best, when it can be obtained; otherwise, a spring mattress or one of horsehair should be employed. It should be well protected by waterproof cloth, &c., from all contact with urine or fæces.

The condition of the bladder should be attended to from the very first. Retention is certain to be present for a time, and over-distension is most injurious. The utmost care ought to be employed in drawing off the water. A moderate-sized elastic or the French vulcanite catheter should be used, and the operation repeated twice a day, night and morning. If the urine becomes offensive the bladder must be washed out with a lotion of boracic acid, ten grains to the ounce; but no syringe should be used. A stream of medicated water ought to be allowed to run in and out of the bladder through an elastic tube attached to the irrigator and fitted to the top of the catheter, no force being applied. (*Vide* Fig. 321.) The application of leeches to the spine, or cupping, is seldom called for. The condition of the bowels must be attended to, and enemata are to be preferred rather than purgatives. The greatest care is needed to keep the patient clean, particularly when incontinence exists.

Retention to be relieved.

Washing out of bladder.

There are no special medicines applicable to these cases. The general health of the patient should be maintained by tonics and simple nutritious food; and sedatives should be given to procure rest and relieve pain.

Treatment.

The condition of the back must be daily watched to prevent bed-sores. This is best secured by removing pressure as far as possible, or in relieving it by means of soft cushions and pads, the water cushion being the best, and also by keeping the parts dry. The application of a soft felt plaster over the sacrum and hips is sometimes beneficial.

Avoid bed-sores.

so also is the frequent application to the parts of some spirit lotion. Should it be necessary to turn the patient on one or other side, the attendants ought to be taught to rotate the hips and shoulders at the same time. By great care and attention life may be prolonged, and even recovery may occur.

Question of trephining.

The subject of trephining the spine requires brief consideration. Cline was the first to put it into practice, and, on his great authority, the operation has been repeated, but with no success. The great argument, however, against the operation is derived from the fact, that in few post-mortem examinations has the condition of parts indicated that the slightest good could have been derived from its performance. The danger of a fractured or dislocated spine lies in the injury to the cord, the result of a stretching or crushing of its substance. When the cord is much injured by the accident the mischief has been done, and no removal of the displaced bone can undo it or neutralise its evil. If the cord is uninjured no operation is called for.

Example.

One successful instance of trephining is recorded by Dr. Gordon, of Dublin, and, in rare and exceptional cases, it is possible the operation may be justifiable. To perform it because it may by chance do good is not advisable. The onus of proving that an operation is likely to be of use, always devolves upon the surgeon who performs it. There is, however, reason to believe, that a cord may at times be only squeezed or pressed upon by effused blood, and, under such circumstances, relief might be afforded by removing enough bone to take away the pressure, and thus give the cord a chance of recovering itself.

Removal of portions of bone.

In the case of Mr. Robertson's patient, referred to at p. 325, such a probability seemed reasonable, and, three months after the accident I cut down upon the injured vertebra, and removed the spinous process and lamina of the fourth cervical, thereby exposing the cord. No harm followed the operation, although no immediate good was produced. The wound healed rapidly, and, in the course of a few weeks, some slight power returned in the muscles of the shoulders, the patient being able to raise the arms from the bed. He, however, made no further progress; and yet I look upon the case as an encouraging one.

Le Gros Clark's remarks.

"The end proposed in an operation of this kind," says Le Gros Clark, "is to remove displaced bone which is supposed to press upon or irritate the cord; but it is most likely to prove abortive, from the inaccessibility of the displaced bone. If the cord have been crushed, and the operation have been consequently useless, probably life may thereby be only curtailed; but if the cord be not crushed, it appears to me that the best chance of the patient's recovery is thereby extinguished. Indeed, my conviction is that the operation has been advocated on the erroneous hypothesis that the spinal cord can be compressed without serious disintegration of its texture."

Wounds of the Spinal Cord.

Wounds.

These are very rare in civil life. They may take place, however, as the result of a stab or gunshot wound. If the cord is injured, some symptoms of paralysis will appear, corresponding with the part that is involved; the extent of the paralysis and its seat fixing the position of the wound. Mr. Holmes has recorded ('Med. Chir. Trans.,' vol. lxv,

1882) an interesting case, in which the theca vertebralis was opened in the lumbar region with a knife, and in which cerebro-spinal fluid escaped in considerable quantities for seven days without any bad result.

Sprain of the Back.

Sprains and their varied effects.

The word "sprain" is very broad, and, when applied to the back is indeed vague. It may mean simply a stretching of the muscles or ligaments of the back, or a more complete laceration of the latter, and separation of the spinous processes of the vertebræ with exposure or injury of the cord. The number of articulations in the spine, numbering nearly eighty, renders such an accident as a sprain a common occurrence; any twist of the spine, or forcible flexion, may consequently injure some of these joints. Sprains may, moreover, be followed by acute or chronic joint disease of a serious and insidious nature; and this truth should ever be before the surgeon to influence his practice. When the head is bent violently forward, the muscles and ligaments may be so torn as to give rise to effusion of blood, swelling, and severe local pain. When the body is flexed with violence not sufficient to give rise to fracture, there may be the same results, and so also when a man falls upon his buttocks. In each case there may be external evidence alone of injury, or, there may be evidence of some affection of the cord, such as is afforded by the presence of paralysis, proving that the cord has been stretched, if not permanently injured. If the symptoms rapidly or even gradually subside, no grave mischief probably may have taken place. When they are persistent or obstinate, a less favorable opinion should be formed. If the lumbar region is the part involved, it is not uncommon for hæmaturia to appear, and this may be slight and pass away, or be more persistent. It is not generally a very serious symptom, unless the kidney is ruptured; as a rule, it disappears gradually, and no evidence remains that organic renal disease is ever the consequence. "Of the many cases I have witnessed," says Le Gros Clark, "I have never had reason to suspect that nephritis or organic disease followed." ('Brit. Med. Journ.,' October 3rd, 1868.) Mr. Shaw, in 'Holmes's Surgery,' gives a case where the bleeding lasted for four days, ceased for two, and then reappeared in all its severity. After the lapse of two more days it again ceased for twenty-four hours, reappearing for a third time severely, then ceasing, and a good recovery followed. When the kidneys are diseased, and when calculi also exist in them, this symptom is more likely to appear after injury.

The source of organic disease.

Hæmaturia.

Hæmorrhage into spinal canal.

Hæmorrhage may take place into the spinal canal as the result of a sprain, or, laceration of the ligaments, the blood probably flowing from a laceration of some of the large veins that surround the cord, or, from a spinal artery. Sir P. Hewitt has related a case of sudden death from a fall on the head, recorded by Dr. Deville in 1843 (Mém. de la Soc. de Chirurg. de Paris,' t. iii), in which no other injury was found to the nervous centres than hæmorrhage into the canal in its whole length. Mr. Le Gros Clark has recorded a second, in which a man was struck violently on the back, though there were no immediate spinal symptoms. Paraplegia soon followed, however, which extended upwards destroying life by asphyxia; and, after death, the theca was found distended with fluid blood derived from a ruptured spinal artery. He gives also another case somewhat similar in symptoms, though not in result, where the patient recovered after two years.

e spine and cord; and this absolute immobility of the
l be maintained for months.
he horizontal position for seven or eight weeks is essential
ere cases, and, even in the mildest forms, exercise must be
with caution.
æmaturia occurs, it requires no special treatment unless
n gallic acid, in gr. v or gr. x doses two or three times a day,
en, or, what is better, the subcutaneous injection of ergotin
two to five grains, dissolved in five or ten minims of dis-
employed.

CURVATURE OF THE SPINE.

two forms of curvature of the spine, *lateral* and *angular*.
is due to a relaxation of the ligaments and muscles of the
, in a healthy subject maintain the bony column in its
ition. The *angular* is secondary to organic disease of one
the bodies of the vertebræ, or of the intervertebral sub-
d is generally known as "Pott's curvature."

Lateral Curvature of the Spine.

y far the more common form of spinal curvature. It is Lateral curvature.
und in girls between ten and twenty years of age; some-
ng children, and is frequently, though not always, asso-
want of power. It is more common in the middle and
es of society, where sedentary occupations and luxurious
habits too often exist, than in young women who make full
eir muscles and lead an active life.
uraged by any one-sided posture of the body, whether this Early symptoms.
t of some faulty habit, or of occupation; of over-use of one
ny disease or deformity of a lower extremity which occasions
of the limb.
ly stage it is seldom discovered, and attention is, as a rule, Deformity.

Rotation of spine usually present.

Associated with the lateral curvatures there necessarily must be some rotation of the spine. The amount of this is very variable, and depends upon the extent of the curvature; it is, doubtless, due to the forcible bending of the bones downward with the ribs, these latter helping to rotate the vertebræ upon their axes. The bones may be so twisted that their transverse processes project backward, carrying the ribs with them, the anterior surfaces of the bodies of the vertebræ looking towards the convexity of the curve, and the spinous processes laterally towards the concavity. The thorax is thus much distorted; the side corresponding to the curve being expanded, and the opposite one greatly contracted. This is well seen in the annexed drawings, Fig. 83 taken from a living patient, and Fig. 82 from a preparation.

In some otherwise healthy and in rachitic subjects there exists an exaggeration of the natural curves of the back. When it is in the upper dorsal region and backwards, it is called "*cyphosis*," when in the lumbar and forward, "*lordosis*." This latter curve is very frequently found as an accompaniment and result of hip disease, when the thigh is flexed or adducted; and it is always present in congenital displacement backwards of the head of the femur.

Diagnosis.

The diagnosis is not very difficult when the deformity is well developed, the double curve giving the spine a sigmoid form, which is typical. In less severe cases this curve can readily be removed by extension of the body, either by lifting the patient from the ground by a hand in each axilla, or by, what is better, the vertical suspension of

Fig. 82.



Fig. 83.



Lateral curvature of the spine.

Anterior view. Posterior view.

Guy's Hosp. Mus., No. 1006[60]. Taken from Emma J—, æt. 14.

the patient by his hands from a bar or a pulley. In the more severe forms, such as that shown in the above figures, the deformity is p

ment, the ribs are thrown out in an extreme degree, pushing the scapula outwards and upwards, and the lumbar curve is in the opposite direction to the dorsal. The whole thorax, abdomen, and pelvis are altered in shape and position by the deformity.

Treatment. TREATMENT.—In treating these cases it is necessary in the first place to determine the cause of the deformity. Should there be any structural disease, such as a growth, or carious bone, these will require attention, and the alteration in the spine becomes thereby a secondary matter. But in the great majority of cases of lateral curvature the original affection is the result of impaired health, and constitutional remedies are demanded. The treatment must be directed to an improvement of the general health, and tonics should be administered, such as iron, quinine, and cod-liver oil. Good air and good food are also essential. In certain cases local treatment is of great value.

When due to debility.

The feeble muscles and weakened ligaments should have rest, though they are to be kept in health by moderate exercise; they are never, however, to be fatigued. If fatigue be experienced from walking one hour, such exercise must be curtailed to a shorter period. If backache be produced by exertion, less must be taken. Exercise is to be allowed, but not to the extent of producing fatigue. Sitting and standing ought not to be exceptioned. The patient should recline at stated intervals in any position that gives the greatest ease. When the deformity is definite and the dorsal curve is to the right side, as is nearly always the case, the patient should rest upon that side with a pillow beneath the right arm; the weight of the body in that position acting as an extending force upon the curved spine, and thereby tending to reduce the curve. By resorting to this practice two or three times a day for a definite period, depending upon the nature and severity of the affection, much good may be obtained, and very severe curvatures remedied. Cold sponge or shower baths, if they can be borne, are always beneficial, so also is a moderately firm bed, a spring mattress being better than a feather bed. Gentle calisthenic exercises are valuable adjuncts to treatment when practised with discretion, and particularly the voluntary vertical extension of the patient's body by manual suspension from a bar or pulley; yet, it should be remembered, that a weak spine is being dealt with, and anything like violence may be very detrimental.

Should the curvature have been encouraged by any faulty habit, such as standing on one leg, or in one position, or the use of one arm, it is almost needless to say that the habit should be discontinued.

General objects of treatment. The objects of treatment are, therefore—1. To improve the general condition of the body. 2. To give rest to the strained and weakened muscles and ligaments. 3. To strengthen the muscles that support the spine by exercise carefully regulated, so as to prevent fatigue. 4. To restore the spine to its normal direction by posture, muscular extension, and by pressure applied in the horizontal position.

On mechanical support. **Mechanical contrivances** have been much vaunted, and are often employed, I confess, however, to having little faith in their value as *curative agents*. They tend to cause atrophy of the muscles that support the back instead of strengthening them, and thus to make the deformity permanent. In bad and exceptional cases they may, however, be employed when the treatment sketched out cannot be borne or is inapplicable. The best *support* is that of Sayre's or one of the *felt jackets*. *When the deformity is irremediable* and support essen-

Useful in exceptional cases.

tial, to allow the patient to move about, an instrument is of great value.

It is probable that the deformity in its early stage chiefly arises from a compressed condition of the intervertebral substance, it being well known that this material is capable of being compressed one fourth of its thickness. Hence a person by maintaining the erect posture during the day will be an inch shorter at night than in the morning. Any lateral curvature of the spine, however produced, unless remedied, will increase and be complicated with rotation. When unequal vertical compression is, therefore, kept up, the deformity produced by it becomes permanent, and the growing bones necessarily assume shapes and positions corresponding to the deformity, and tending to increase it.

Organic Disease of the Spine and Angular Curvature.

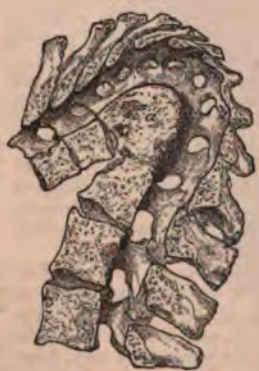
Angular curvature.

This disease of the spine is due to a destructive inflammatory change of the bodies of the vertebræ and intervertebral substances. It begins usually in the latter structure, although the bone itself may be its primary seat. It is at times associated with tubercular deposit in the tissue, though there is no evidence to prove that it is always due to the presence of tubercle. The curvature, generally known as Pott's curvature, is directly due to the destruction of the bodies of the vertebræ and the intervening intervertebral substance, the upper vertebra falling down towards the lower, and joining with it. When the bodies of many of the vertebræ are involved, the deformity will be severe; a preparation in Guy's Museum (1006[50], Fig. 84) shows the bodies of twelve vertebræ implicated, but a cure resulted. Paralysis may attend this affection, though it is rare to find the cord involved in the disease, even when the most destructive changes have taken place in the bones. Great deformity, even to an acute bending of the cord, may exist, without giving rise to nervous complication (Fig. 84A). The

Pathology.

Spinal paralysis.

FIG. 84.



Angular curvature of the spine.

FIG. 84A.



Angular curvature of the spine, same as that illustrated in Fig taken from a patient æt. 38.

paralysis, too, may be lasting, but more commonly is only temporary. Angular curvature may occur at any period of life, but is more liable to appear during the growth and development of the spine; and, consequently, is more frequently found in childhood. From a remarkable preparation in the Guy's Hosp. Mus. (1004[22]) it would seem that it may exist in the fœtus in utero and be repaired, the bodies of three or four of the dorsal vertebræ in this case being clearly fused together from disease, thus giving rise to angular curvature.

When a cure takes place it is generally by anchylosis; occasionally, however, the parts are held together simply by fibrous tissue. Termination in anchylosis.

The disease more commonly attacks the lower dorsal region of the spine than any other, although the cervical and lumbar regions are not seldom implicated. In rare cases it attacks two different regions of the spine. It may run through its whole course even to a cure, without giving rise to any external suppuration; more commonly, however, an abscess makes its appearance. Situation of the disease.

Spinal abscess.—Pus will sometimes find its way from the dorsal region beneath the fascia that covers in the psoas muscle under Poupart's ligament, and then appear as a swelling in the groin at the inner half (*psoas abscess*). The swelling may burrow downward, and involve the whole thigh in one large abscess. When the disease is in the lumbar region, pus may burrow between the various layers of fascia that bind in the quadratus lumborum muscle, and appear in the front of the abdomen, above Poupart's ligament, and in rare cases pass down the inguinal canal and appear in the groin, simulating an inguinal hernia, or in the loin (*lumbar abscess*). In other cases it will make its way under the fascia that covers in the iliacus muscle, and appear beneath Poupart's ligament, but at its outer half. In other instances, again, the matter will find a passage downwards into the pelvis, and either make its way through the sciatic notch into the gluteal region (*gluteal abscess*), or pass downwards behind the trochanter major to the thigh. In still rarer cases the pus appears by the side of the rectum. Spinal abscess. Psoas abscess. Lumbar abscess. Gluteal abscess.

When the cervical region is the seat of the disease suppuration may appear in the pharynx as a *pharyngeal abscess*, or externally in the neck behind the sterno-cleido-mastoid muscle. The following case is a good example of this: Pharyngeal abscess.

A boy, æt. 3, was brought to me at Guy's, in 1862, for some affection of his upper cervical vertebræ, consequent on a fall downstairs upon his head. An abscess formed two months after the accident behind the left sterno-cleido-mastoid muscle, from which place a piece of the lamina of a vertebra escaped six months afterwards. He kept his bed for upwards of a year, when he got up with a stiff neck. He was unable to nod or rotate the head, clearly showing that the joints between the occipital bone and the first two vertebræ had been diseased and become anchylosed. In 1867 this boy again came under my notice. His head was quite fixed: the cervical vertebræ seemed shorter than usual, but no irregularity existed. Examples.

The annexed drawings (Figs. 85, 85A, 85B), taken from Ellen T—, æt. 14, a patient of Mr. Poland's, illustrate a severe case of cervical disease with lateral deformity. In this patient, a good result was obtained by means of the apparatus depicted in Fig. 85B, the cure resulting *in anchylosis.*

Exfoliation of bone.

From any of these abscesses bone may exfoliate, and it may be coughed up from the pharynx, or discharged through the neck. I have seen a mass of bone, the size of a nut, come away from a lumbar abscess, and a piece of bone, clearly spinal, discharged from an abscess of the thigh,

FIG. 85. FIG. 85A. FIG. 85B.



opening above the knee-joint. In a case brought under my notice by a valued dresser, Mr. Burgess, the anterior half of the atlas, with its articular facets, was expectorated, recovery ensuing, the man being well eight years subsequently; and, in Guy's Hosp. Museum (prep. 1018[a]) there is a preparation of the odontoid process which a woman, who had had a stiff neck for months, coughed up, and from which complete recovery ensued. Mr. Keate as long ago as 1835, recorded ('Med. Gaz.) a case in which the anterior half of the atlas exfoliated, and Mr. Collis, in his book on 'Syphilis,' and Mr. Coppinger of Dublin, in the 'Dublin Journ.,' Dec. 1879, have both published instances in which the corresponding portion of bone exfoliated. In fact, from all these *spinal abscesses*, bone may be discharged, and, what is more, recovery follow.

FIG. 86.



Synostosis of ribs to vertebræ, &c.

Anchylosis without suppuration.

Suppuration, however, does not always take place. A woman, æt. 30, came under my care in 1858 for a stiffness of her head and neck, that had been increasing for two years, and which she regarded as rheumatic. When I saw her the head was immovably fixed and slightly rotated to the right side. Rotation and nodding were impossible. There was much thickening about the cervical vertebræ, with pains darting upward to the vertex and downward to the shoul-

st in bed, fomentations, and tonics, all these disappeared and ry ensued, but with a stiff neck. My colleague, Dr. Fagge, has corded, in the 'Path. Soc. Trans.' for 1877, a remarkable case of osis of the arches of the vertebræ, of the ribs to the vertebræ, the hip-joint, in which a bending of the dorsal vertebræ forward mmobility were the only symptoms of spinal disease that existed life (Fig. 86). It occurred in a man, æt. 34, who died with in- ation and dilatation of the bronchial tubes from asphyxia, his ing having been entirely diaphragmatic from a want of move- in the costal joints.

Diagnosis.

gnosis.—When an angular curvature of the spine exists there e no difficulty in recognising the nature of the disease, or the s by which the curvature has been brought about. When a abscess coexists with the deformity, there is good reason to sus- hat the one is the direct result of the other, more particularly the suppuration can be traced up to the spinal deformity. But

Of early stage.

early stage of the disease, the diagnosis is not so easy, and yet ere that a correct one is most needed, for if any decided good is gained by treatment, it is at this early period. What, then, are lications which denote the presence of incipient spinal disease? *and persistent pain* is probably the earliest, and when this is panied by *local tenderness* on firm pressure, and pain is experienced distribution of any of the nerves coming from the seat of the on, as over the shoulders and down the arms in lower cervical e, around the abdomen and above the umbilicus in upper dorsal, low the umbilicus and down the thighs in lumbar disease, the n's suspicions should be excited. When the patient complains sudden jar of the back by a slip down stairs, or by any jump; to these symptoms he exhibits extreme caution and a *rigidity*

FIG. 87A.



FIG. 87B.



Mode of detection.

spine in walking or moving; and when, on being told to pick nything from the ground, *he bends his knees in preference to*

bending his back (Fig. 87, A); and when, moreover, he rolls off a couch instead of rising up boldly from the recumbent posture, and supports his body, when standing, with his hands either upon his thighs or neighbouring piece of furniture (Fig. 87, B), the diagnosis becomes certain. When moreover coughing or sneezing excites pain, and last, but not least, when any constitutional disturbance is present, such as a quick pulse, occasional febrility, and a furred tongue; when all these symptoms, or many in combination exist, during that period of life when bones are growing, and bone disease is apt to appear, the surgeon should always suspect disease of some portion of the spine, and, until he can satisfy himself that none such exists, it is a wise plan to treat the case as if it were present. It is true that, by adopting this rule of practice, he will be occasionally misled, and at times treat a case of hysteria as one of spinal disease; but then what harm? He will probably do good to the hysterical patient by the treatment he would adopt for the spinal complaint, while he would certainly do much harm to the latter, by neglecting such measures as are essential for its successful treatment.

May simulate hysteria.

Treatment.

TREATMENT.—It is an interesting clinical fact that the best cases of recovery from the worst examples of spinal curvature and disease are to be found amongst that miserable class of patients who have never had any chance of receiving proper treatment; who have never had rest or any care; in whom the disease has run its course untended and uncared for, and yet, in whom a cure has taken place with firm anchylosis, although with deformity. The majority of these cases are examples of disease of the dorsal vertebræ. How far this deformity might have been lessened or prevented by proper treatment, is an open question. Nevertheless, it is beyond all doubt that in the early stage of this disease, immobility of the spine, rigidly and persistently maintained, and the removal of downward pressure upon the vertebræ are absolutely essential points of practice to be observed. Not, however, rest upon the back, for in many instances this supine position tends rather to separate parts that ought to be kept in contact; but rest in any position, prone or supine, the patient feels to be most comfortable.

Value of immobility.

The general health of the patient must be maintained, as much as possible, by simple nutritious food, stimulants enough to assist digestion, and no more, with tonics, such as iron, quinine, and cod-liver oil.

When pain exists, local fomentations are often a comfort; occasionally too the application of a few leeches relieves. Small flying blisters placed alternately on either side of the painful spot are sometimes of use, and a plaster of belladonna or opium rubbed down with glycerine over the part, is a valuable adjunct. When severe nerve pain is present, the hypodermic injection of morphia may be used. Sedatives must be given to induce sleep when it cannot otherwise be obtained. Setons, moxas, and mercury are not to be recommended.

Setons condemned.

By the adoption of this line of treatment a cure may be obtained. It must, however, be followed out for months, and even years; the greatest care being taken that the patient is not released too soon, for a relapse is always a very serious affair.

Dr. Lewis A. Sayre's plaster-of-Paris jacket appears to me to be the best kind of apparatus, for it is simple, economical, easily applied, and efficient, securing absolute immobility of the spine, and at the same time giving comfort to the wearer. It can be readily applied by an

Sayre's jacket.

medical practitioner with little expense, and does not debar the patient from the benefit of fresh air and change of scene.

The body of the patient to whom it is to be applied is first to be covered with a thick closely-woven merino shirt, which is to be fastened above over the shoulders, and below between the thighs; in a female over a handkerchief. A pad, which Sayre calls a dinner pad, made of cotton wool, folded in a handkerchief so as to form a wedge-shaped mass with the thin edge downwards, is then to be introduced beneath this shirt over the region of the stomach, of sufficient size to supply, when it is removed, a space which will permit of distension of the abdominal parietes. All projecting spinous processes of vertebræ are to be protected from pressure by the application on either side of them of a strip of thick felt plaster. The patient is then to be supported by straps carefully adjusted to the axillæ, symphysis mentis, and occiput (Fig. 88), attached to the extremities of a cross bar which may be suspended from a hook fastened to a beam or high door by a compound pulley, the body being sufficiently suspended to allow of its weight serving as an extending force, but *always within the limit of pain*. Elevation of the heels is enough for the purpose. The trunk is then to be carefully encased from below the crests of the ilia upwards to the axillæ by the rapid application of coarse muslin or crinoline bandages, 2½ inches wide, into which *dry freshly-ground* plaster-of-Paris has been rubbed, the bandages just before they are used being placed vertically in tepid water deep enough to cover them, and left a sufficient time to allow all bubbles to escape. The bandages should be well squeezed before they are rolled round the body, and in their application care should be taken to see that they are applied flat, without making any traction, and well smoothed down. It is well also during this process to wet the jacket with water, and rub in more plaster.

Its application.

Dinner pad.

Protects spinous processes.

Bandages.

The patient should be laid down in the recumbent position upon a mattress before the plaster is quite set, the dinner pad removed, and the casing slightly flattened in front of the anterior superior spinous processes of the ilium, to guard against pressure. The merino jacket may then be unfastened beneath the thighs and above the shoulders, and turned at both ends over the casing, the ends being fastened down by a few extra turns of the plaster bandage.

In the course of a fortnight, if all things go on well and no evidence of undue pressure in any part exists, the casing may be split up along the front, its edges bound, eyelets introduced, and a lace inserted, in order that it may at times be removed for personal cleanliness and comfort, and reapplied. The jacket should be worn so long as it is easy, and when worn out another should be substituted.

When the cervical or upper dorsal region is diseased, a vertical splint, Sayre's jury-mast apparatus (Fig. 88A), to take off pressure of the head and prevent rotation, will be required.

When this splint is used for lateral curvatures the patient should suspend himself by his arms.

In female patients, a pad should be placed over each breast and removed with the dinner pad just before the plaster sets. Smaller pads may likewise be placed over the anterior iliac spines. "When the disease is situated in the dorsal region the jacket should not be opened, the reason that if the respiratory movements of the chest are per-

mitted to go on without restraint, the heads of the ribs will necessa
move freely and the disease will be increased rather than diminish
But if the ribs be held still, and the diaphragm thus made to act

FIG. 88A.



FIG. 88.

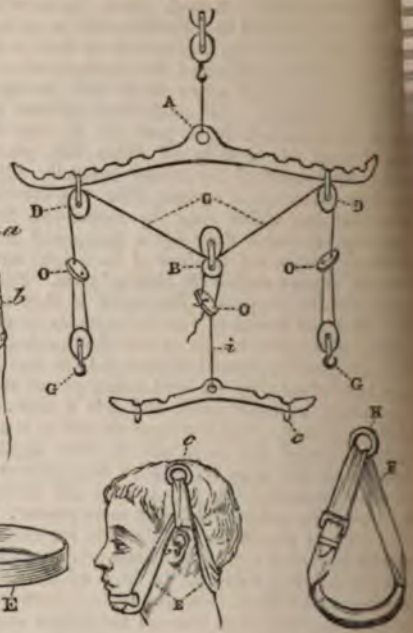


FIG. 88.—Description of Sayre's apparatus as improved by Golding Bird, by which the drag on the arms and head can be varied by altering the relative length of cords and G. The smaller the angle at G the more the drag on the head, and *vice versa*.

A. Cross-bar suspended by running tackle to Sayre's tripod or to hook secured to cross-beam of a folding door. B. Pulley, acting upon central bar, to the end of which are suspended the iron rings *c*, attached to head-piece, E. D. Pulleys connected with arm suspender, F, by hook G, and H, ring, worked by running cord 36 inches long, which can be lengthened at will and fastened by cleats, O. E. Head-piece made of 2-inch worsted webbing sewn into a circle 27½ inches for adult, 23 inches for children, with (*a*) chin-piece made of wash leather, and (*b*) two circular sliders of same web, 6 inches round, attached to iron rings *c*. The sliders, by being slid forwards or backwards, can be made to pull more or less against the chin or occiput. F. Arm-pieces made of 2-inch cotton-web one yard round, capable of being shortened by buckle. They are softly padded with horsehair in the middle, and covered with wash leather; each carries an iron ring H. On first suspending a patient the running cord, G, should be at its shortest, the centre cord, *i*, at its longest.

FIG. 88A. Sayre's jury-mast apparatus.—*a*. Two pieces of malleable iron bent to fit the curve of the back. *b*. Three or more roughened strips of tin attached to iron, long enough to encircle the body. *c*. Central shaft carried in a curve over the top of the head and capable of being elongated at will, springing from cross-pieces of *a*. *d*. Swivel cross-bar with hooks attached to end of *c*, from which straps depend to support head and chin collar, *c*. This apparatus is applied over the jacket with a plaster bandage.

fully, the breathing, instead of being thoracic, is rendered diaphragmatic and abdominal, and all the short, grunting, catching respiration ceases."

In *acute* or progressive disease suspension is dangerous, and vertical extension is to be applied with the greatest caution. Immobility of the spine is the essential object to secure. Caution.

Spinal abscesses should not be opened hastily, inasmuch as they may become absorbed and wither away. When steadily progressing, however, they must be dealt with, and a good method is without doubt to make a free opening under a piece of lint saturated with oil carbolised or not. I have, however, in recent years, made a free opening into the abscess without any such precautions, washed out the abscess cavity with iodine water, boracic acid, or chloride of zinc lotion, 2 grs. to the oz., with equally good results—making the opening so free that no pus could be retained, and, if air got in, it as freely got out again. In all cases a drainage tube should be introduced, and the cavity kept empty and clean by repeated irrigation. Retained pus and air are sure to decompose, but if a free vent be made for both, harm rarely ensues. To allow abscesses to enlarge to any extent without interfering is not good surgery, as the amount of constitutional disturbance that follows the opening of an abscess is closely proportioned to its size, and a large abscess cavity secretes more pus than a small one. It is true that, after the opening of a chronic abscess, a patient who may have been fairly well becomes feverish, and possibly exhausted by hectic; but it should be remembered that, by delay, the abscess will become larger, and the constitutional disturbance as a consequence more severe, when the opening has taken place. Treatment of spinal abscesses.

Disease of the upper cervical vertebræ.—Disease of the upper two cervical vertebræ and of the occipital articulation is often found, and may be accounted for by the greater mobility of the joints, and consequent liability of the ligaments to sprain and laceration. Disease may be situated in the bones entering into the formation of the joints, or in the soft parts binding them together; and, with the disease, some displacement of one of the vertebræ is occasionally met with. When the disease is in the second vertebra, the odontoid process may separate and even exfoliate. Disease of cervical vertebræ.

When the transverse ligament is diseased, the odontoid process may become displaced and the cord injured (Guy's Museum, prep. 1289[32]). When the displacement is great, sudden death may take place under these circumstances; and when partial, more or less paralysis may come, according to the amount of pressure the cord has sustained. Fixed pain about the cervical vertebræ with pain in the occipital region in the distribution of the occipital nerves and stiff neck, is always suspicious of cervical disease; and, when to this is added a disinclination to rotate the head, and a preference to rotate the body instead; when the chin is tilted up, and a modified form of opisthotonos exists, or there is slight torticollis; when the patient supports the chin with his hand to prevent it falling forwards on the sternum; and when pain is aggravated by rotation or downward pressure of the head, the case is serious, and the diagnosis clear. Giving way of the transverse ligament.

TREATMENT must be conducted on recognised principles. The danger of sudden death by the displacement of the bones must be diminished by the *application of a support to keep the* head straight and prevent Treatment.

mitted to go on without restraint, the heads of the ribs will nece
move freely and the disease will be increased rather than dimi
But if the ribs be held still, and the diaphragm thus made to ac

FIG. 88A. FIG. 88.

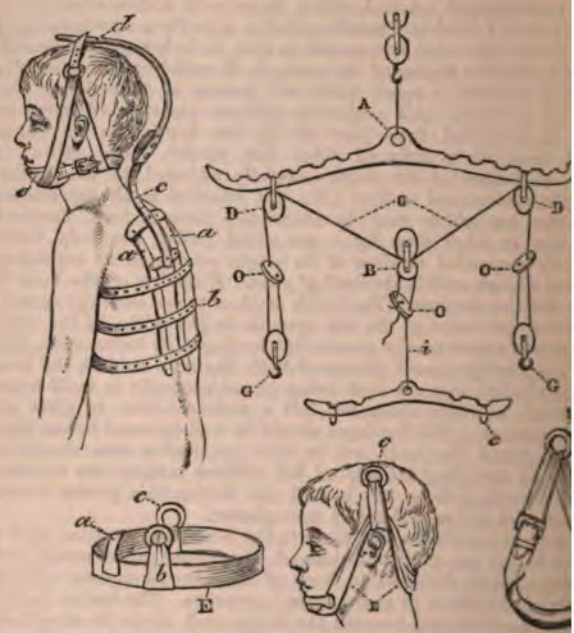


FIG. 88.—Description of Sayre's apparatus as improved by Golding Bird, by w
drag on the arms and head can be varied by altering the relative length
and G. The smaller the angle at G the more the drag on the head, and
A. Cross-bar suspended by running tackle to Sayre's tripod or to hook secured
beam of a folding door. B. Pulley, acting upon central bar, to the end of
suspended the iron rings *c*, attached to head-piece, E. D. Pulleys connec
arm suspender, F, by hook G, and H, ring, worked by running cord 36
which can be lengthened at will and fastened by cleats, O. E. Head-p
of 2-inch worsted webbing sewn into a circle 27½ inches for adult, 23
children, with (*a*) chin-piece made of wash leather, and (*b*) two circular
same web, 6 inches round, attached to iron rings *c*. The sliders, by bei
wards or backwards, can be made to pull more or less against the chin
F. Arm-pieces made of 2-inch cotton-web one yard round, capable of
tened by buckle. They are softly padded with horsehair in the middle,
with wash leather; each carries an iron ring H. On first suspending
running cord, G, should be at its shortest, the centre cord, *i*, at its lon

FIG. 88A. Sayre's jury-mast apparatus.—*a*. Two pieces of malleable iro
the curve of the back. *b*. Three or more roughened strips of tin attached
long enough to encircle the body. *c*. Central shaft carried in a curve
top of the head and capable of being elongated at will, springing fro
pieces of *a*. *d*. Swivel cross-bar with hooks attached to end of *c*, fro
straps depend to support head and chin collar, *e*. This apparatus is cover
the jacket with a plaster bandage.

lly, the breathing, instead of being thoracic, is rendered diaphragtic and abdominal, and all the short, grunting, catching respiration ases."

In *acute* or progressive disease suspension is dangerous, and vertical tension is to be applied with the greatest caution. Immobility of Cautio
e spine is the essential object to secure.

Spinal abscesses should not be opened hastily, inasmuch as they may Treatm spinal abscess come absorbed and wither away. When steadily progressing, however, they must be dealt with, and a good method is without doubt to ake a free opening under a piece of lint saturated with oil carbolised not. I have, however, in recent years, made a free opening into the scess without any such precautions, washed out the abscess cavity th iodine water, boracic acid, or chloride of zinc lotion, 2 grs. to e oz., with equally good results—making the opening so free that pus could be retained, and, if air got in, it as freely got out again. all cases a drainage tube should be introduced, and the cavity kept npty and clean by repeated irrigation. Retained pus and air are sure decompose, but if a free vent be made for both, harm rarely ensues. o allow abscesses to enlarge to any extent without interfering is not ood surgery, as the amount of constitutional disturbance that follows he opening of an abscess is closely proportioned to its size, and a large bscess cavity secretes more pus than a small one. It is true that, after he opening of a chronic abscess, a patient who may have been fairly well becomes feverish, and possibly exhausted by hectic; but it should be remembered that, by delay, the abscess will become larger, and the constitutional disturbance as a consequence more severe, when the opening has taken place.

Disease of the upper cervical vertebræ.—Disease of the upper two Disease of cervical vertebræ. cervical vertebræ and of the occipital articulation is often found, and may be accounted for by the greater mobility of the joints, and consequent liability of the ligaments to sprain and laceration. Disease r be situated in the bones entering into the formation of the joints, n the soft parts binding them together; and, with the disease, some acement of one of the vertebræ is occasionally met with. When sease is in the second vertebra, the odontoid process may separate en exfoliate.

en the transverse ligament is diseased, the odontoid process may Giving way of the transverse ligament. displaced and the cord injured (Guy's Museum, prep. 1289[33]). he displacement is great, sudden death may take place under rcumstances; and when partial, more or less paralysis may ccording to the amount of pressure the cord has sustained. ain about the cervical vertebræ with pain in the occipital the distribution of the occipital nerves and stiff neck, is spicious of cervical disease; and, when to this is added a disn to rotate the head, and a preference to rotate the body when the chin is tilted up, and a modified form of opisthots, or there is slight torticollis; when the patient supports with his hand to prevent it falling forwards on the sternum; pain is aggravated by rotation or downward pressure of the ase is serious, and the diagnosis clear.

ENT must be conducted on recognised principles. The danger Treatment. leath by the displacement of the bones must be diminished ication of a support to keep the head straight and prevent

slow and associated with pain in the injured part, the application of a small blister is beneficial. Divided nerve should always be brought together by sutures, and the limb placed in the best position to prevent any separation of the divided ends; the paralysed parts should be kept warm with cotton wool and of an equable temperature, and the whole limb at rest, until complete repair has taken place. Even after a nerve has been divided for some weeks, there is a good prospect of the divided ends uniting on their readjustment by sutures after fresh transverse sections have been made of the separated ends (*vide* Hulke, "Address on Surgery," 'Clin. Soc. Trans.,' vol. xii). Mr. Favell, of Sheffield, has recently published some good cases in favour of the practice, and Dr. Weir Mitchell has shown that in 120 cases of nerve section, regeneration of nerve took place in most in about six months. When much pain exists, belladonna or opium rubbed down with glycerine is a nice application, and the hypodermic injection of morphia is often of much value. The application of a suture to a divided nerve is not, however, uniformly successful.

'Brit. Med. Journ.,' Aug. 5th, 1876.

'Amer. Journ. of Med. Sci.,' April, 1876.

Neuralgia.

Neuralgia, tic douloureux.

The subject of neuralgia belongs more properly to the physician than to the Surgeon, yet the latter is often called upon to consider cases of this nature. The first point to determine is whether the pain is due to any local cause, and, if so, to remove it. Thus, a decayed tooth too often is the cause of pain in the course of branches of the fifth nerve, although the tooth may have neither ached nor exhibited any external evidence of decay. The pressure of a small tumour on a nerve, some irregularity in the bone, or a cicatrix involving a nerve, are causes which sometimes require the Surgeon's interference to effect a cure. The following example illustrates these remarks:—A man, æt. 41, came under my care in 1866 for severe pain down the anterior and outer portion of his left leg and foot, with almost complete paralysis of the extensor muscles. The symptoms had been coming on gradually for years, and had followed a severe wound sustained twelve years previously, over the head of the fibula. There was a hard cicatrix over the head of the fibula, which clearly involved the external popliteal nerve. I made two deep vertical incisions on either side of the cicatrix, by this means taking tension off the nerve, and affording complete relief; six weeks later he was still well. Whenever neuralgic pain is associated with a cancerous tumour, or comes on after its removal, the Surgeon should suspect the existence of some secondary cancerous deposit in the course of the sensory nerve.

Local cause.

Example.

Neuralgia in cancer.

The great majority of cases of neuralgia, however, have a constitutional origin, and their cause is to be found in some hereditary tendency, in depression, anxiety, or some obvious derangement of health, such as is expressed by the term anæmia. Many, too, have a malarious origin, and depend on climatic influences, such as residence in a damp or wet place. The disease known as "tic douloureux" is an affection of the fifth nerve and its branches, but any nerve in the body is liable to suffer. The pain is often very intense, and recurs in paroxysms at certain hours, or on exposure to draught or cold.

Treatment. Local.

TREATMENT.—The treatment of these cases of neuralgia must be regulated entirely by their cause. When a local cause can be made out, its removal is the only remedy—for example, the removal of

a tooth, of a tumour, or of a bulbous extremity of a nerve. When hysteria complicates the case, or any uterine disturbance, tonics are suggested, such as iron, zinc, or quinine, and of these full doses may be given. When malaria appears to be the cause, bark or quinine is invaluable. In all forms of local neuralgia, more particularly in *sciatica*, the hypodermic injection of morphia in one-third or half-grain doses, injected in the course of the nerve, often acts as a charm. Chloroform, belladonna, and opium, locally applied, are also valuable. The general condition of the patient should always be attended to, and the treatment directed to its improvement. Good food, fresh air, and tonics are always essentials. Purgatives are seldom necessary, and must be regulated so as not to depress. Stimulants, but not in excess, are of great use. In females, the condition of the uterine organs should always be carefully attended to. General.

In obstinate cases of neuralgia, the division of the nerve has been performed with occasional success. It is not, however, an operation in favour of which much can be said. When the cause of the neuralgia is peripheral it may succeed for a time, but in these cases spontaneous recovery is not unusual; and, when some central mischief is the source of the pain, the operation is not likely to be of service. Nevertheless, in desperate cases, the excision of a portion of the offending nerve is a justifiable operation; it has been of use, and may be so again. Sir J. Fayrer has related in the 'Med. Times' for 1868 a case of sciatica in a syphilitic man, æt. 30, in whom swelling was detected in the nerve sheath, and pain was at once relieved by puncturing the part with a knife. Division of nerve.

As much may likewise be said for nerve-stretching, which is to be preferred.

Neuroma.

Neuroma.

Any tumour connected with a nerve is called a neuroma. These neuromata may be of a fibrous or of a fibro-cellular kind, and there is reason to believe that they have an inflammatory origin. They may be very small, or of large dimensions, and when large they may contain cysts. Sometimes they are developed *within* the nerve sheath; at others they are situated *upon* it. In a third class the fibrillæ of the nerve trunk appear to be separated by the new tissue, or to become incorporated with the growth. They are at times single, but more frequently multiple; and occasionally involve nearly every cerebro-spinal nerve in the body. Wilks has recorded such a case in the 'Path. Soc. Trans.,' vol. x, in which, after death, neuromata were found all over the body, appearing as nodules on some nerves, and as distinct tumours on others; the nerves appeared of irregular size and were indurated, the fibrous tissue being infiltrated among the nerve-fibres. The pneumo-gastric nerve had a tumour the size of an egg upon it. Dr. Smith, of Dublin, in his unrivalled monograph on the subject, has recorded an instance in which many hundreds of such tumours existed; other similar cases might be quoted. Pathology.

These tumours are not painful as a rule; indeed, in the most marked examples of this disease, in which the tumours are multiple, they are often not recognisable till after death. Pain, however, is sometimes present, aggravated on pressure, and apparently depending much upon the mode in which the nerve is involved. The affection is not to be confounded with the *painful subcutaneous tumour*. Symptoms.

When the ends of a divided nerve become bulbous from fibrinous effusion, what is called a *traumatic neuroma* is formed. When this becomes involved in the cicatrix of a stump, it is an exceedingly painful affection, and is thought by some Surgeons to be more common after flap amputations than others. It must be remembered, however, that all nerve trunks become more or less bulbous after amputation.

Treatment.

TREATMENT.—There is no reason why neuromata should be removed or touched, unless they are large or painful. When from these causes they require treatment, the operation should be performed, care being observed to dissect the tumour from the nerve, when it is possible, which, however, can rarely be done. In 1882 I removed a cystic tumour, the size of a large nut, with permanent success, from the upper cord of the left brachial plexus of a lady patient of mine, who had suffered continual agonies of pain down the arm; the cyst was in the nerve cord itself. I have removed others from the median and sciatic. In the former case the tumour had been treated by another surgeon as a ganglion and punctured. Many cases are on record in which large neuromata have been excised with the nerve trunk, and a good recovery has followed, even with a restoration of the functions of the divided nerve. Traumatic neuromata should always be excised when causing much pain, but, when associated with symptoms of spinal irritation, which may possibly be due to a neuritis travelling up the affected nerve trunk, the forcible stretching of the nerve, as recommended by Billroth and Nussbaum, and practised by others, should be employed.

Nerve-stretching.

On Nerve-stretching.

In 1869 Billroth cut down upon the sciatic nerve with the view of removing a neuroma, and, though no tumour was found, the manipulation and stretching of the nerve brought unexpectedly permanent relief to the pain the patient had experienced. Three years later (February, 1872) Nussbaum, of Münich, cut down upon the brachial plexus to stretch some of its trunks for painful spasmodic contraction of the flexors of the arm and hand, and the operation was successful.

Since these early operations of nerve-stretching many have been undertaken with very variable success.

'Revue de Chirurgie,' 1882. Paris.
'Med. Rec.,' New York, Sept., 1882.

It would seem, from the excellent papers noted, that when a nerve is stretched extravasations of blood take place within its sheath, above and below the point of traction, where the vessels from the nerves penetrate the sheath, and that these extravasations entirely disappear in about five or six weeks. That embryonic cells under the sheath, and wasting of the superficial nerve-fascicles with some segmentation of the nerve-cells are found. That if the nerve be drawn away *from* the spinal cord, anæsthesia with slight paresis follows; but if *towards* the cord the paresis is increased, and there may be a loss of reflexes.

There is also evidence to show that the stretching may produce some change in the nerve-centres themselves, as indicated by more or less persistent modifications of function of different parts of the body.

In 70 operations for sciatica, statistics indicate that in 60 the patient was either cured or greatly relieved, and that in the majority of cases the relief was permanent.

In 37 operations on the fifth pair of nerves success was reported in 29, and that in traumatic neuralgia the success was equally good.

Nerve-stretching for locomotor ataxia has been attempted in 57 cases, and in 16 with decided success. It has likewise been employed for traumatic tetanus in 50 cases, with 10 recoveries.

Langenbeck states very decidedly that it is better to stretch the sciatic nerve in its middle or lower third below its muscular branches, there being thus less risk of the operation being followed by atrophy of the limbs.

The dangers of the measure are such as attend all operations. It is consequently an operative proceeding of a justifiable kind, but one that requires caution in its application.

The operation. The operation consists in the free exposure of the nerve trunk by incision and the application of forcible traction to it, both proximally and distally. The traction has been great, as one author, in describing the operation as applied to the sciatic nerve, says that "the limb of the patient should be lifted from the table by the sciatic nerve." This is probably unnecessary, but under all circumstances the stretching should be enough to destroy the sensibility of the nerve for some days.

Painful Subcutaneous Tumours.

Painful subcutaneous tumours. These tumours are clinically to be separated from the neuromata which have just been considered, although they have often doubtless been confused with them. They are not, however, nerve tumours. They were first described by Wood, in the 'Edinburgh Medical Journal' for 1812. They are usually single and situated in the subcutaneous tissue, and are rarely larger than a small bean. They are encysted, and give to the finger a hard elastic touch. To the eye they appear bright yellowish or a pearly white, and are made up of fibro-cellular or fibrous tissue. *Intense painfulness* is their clinical peculiarity, although they have no such nerve connection as will explain their excessive sensibility. The pain, says Sir J. Paget, is of the nature of that morbid state of nerve force which we call neuralgia.

Structure. 'Revue de Chirurgie,' 1872, Paris.

The painful character of these tumours is very peculiar. I is not constant, nor does it appear to depend upon any injury, and sometimes comes on without any assignable cause, or after only the slightest touch, the pain beginning in the tumour, gradually increasing in intensity and extent till it becomes almost unendurable, darting from the tumour up and down the limb or over the body. The muscles of the limb may likewise be spasmodically affected. The paroxysm may last only a few minutes, or may continue for hours, and subsides as it appears, gradually, leaving the parts tender that were the seat of pain. These painful tumours are most frequent in the female, the neuromata more frequent in the male.

Excision. Treatment.—The only treatment is the excision of the growth, which is generally effectual. These tumours rarely recur, although Sir J. Paget has recorded one or two examples of recurrence.

CHAPTER VIII.

DISEASES AND INJURIES OF THE EYE, &c.

By CHARLES HIGGENS.

EXAMINATION OF THE EYEBALL AND ITS APPENDAGES.

THE examination of the eyeball will be considered under four heads:—

1st. By the unaided eye.
2nd. By lateral illumination.
3rd. By the ophthalmoscope
 (*a*) Direct examination.
 (*b*) Indirect examination.
4th. By manipulation.

The *refraction* of the eyeball, the field of vision, &c., will also receive a short notice.

I. Examination by the unaided Eye.

Examination by unaided eye.

In order to examine the outer surface of the eyelids, ocular conjunctiva, cornea, anterior portion of sclerotic, aqueous chamber, and lachrymal apparatus, it is necessary to place the patient in a good light (as before a window), and direct him at first to close the eyes, then open them widely, and look by turns in different directions.

How to evert upper lid.

To examine the palpebral conjunctiva it is necessary to evert the upper lid, and to draw the lower one downwards. Eversion of the upper lid can be accomplished thus:—The surgeon standing in front of the patient, should direct him to look downwards and close the eyes; he should then place the forefinger of one hand upon the lid at the attached or upper border of the tarsal cartilage, and make gentle pressure downwards and backwards, so as to cause the free edge of the lid to stand away from the eyeball; then place his thumb beneath the margin of the lid, and make a slight upward movement, at the same time continuing the pressure with the finger; by this means the lid will be made to turn upon itself and become everted; the lid may also be everted by pressing a probe horizontally upon its outer surface, and drawing it upwards by means of the lashes, at the same time making pressure downwards with the probe.

To examine the conjunctiva covering the lower lid, all that is necessary is to place the finger upon the margin of the lid and draw it strongly downwards, when its conjunctival surface will become exposed.

Normal Appearances.

Normal appearance of eyelids.

The outer surface of the eyelids is covered by soft, delicate skin, which is thrown into folds on every contraction of the orbicularis; their free margins are of some thickness. From the outer edge of this free margin project the lashes in two or three rows, those of the upper lid being thicker and longer than those of the lower. The lashes extend along the whole outer edge of each lid, but are much fewer and more delicate in that portion extending from the tear punctum to the inner canthus.

ner edge of each margin is occupied by the orifices of the
n glands, which are seen as a close set of yellowish points.
ular conjunctiva is smooth, moist, shining, and transparent, Of conjunctiva.
the white sclerotic to show plainly through it; a few vessels
nally seen running from the outer and inner canthi towards Ocular.
a, but these are perfectly consistent with a healthy condition
mbrane. The caruncle and semilunar fold occupy the space
ely external to the inner canthus, the former appearing as a
dish-grey projection, the latter as a well-defined pinkish fold.
pebral conjunctiva is also smooth, moist, shining, and trans- Palpebral.
nd appears to have somewhat of a yellowish colour from the
rtilage, to which it is closely and evenly united, showing
it. That portion of conjunctiva reflected from the lids to
(*Fornix*) appears somewhat thickened and wrinkled, and is Fornix.
nore vascular than the ocular and palpebral portions.
parts of the conjunctiva require to be specially examined. Parts requiring special notice.
ions next the thickened margin of the lid, the fornix, and
caruncle, are the most likely situations for the lodgment of
body. That portion covering the attached border of the
rtilage also should be noticed, as it is here that granular
ia manifests itself most plainly.
rnea is smooth, shining, and perfectly transparent throughout, Cornea.
the case of old people, in whom a bluish-white rim (arcus
often seen occupying more or less of the structure, somewhat
s margin; no blood-vessels are seen on its surface or in its
.
terior portion of the sclerotic is pearly white, or of a pale Sclerotic.
t, and shining. It is plainly visible through the transparent
va covering it; some fine vascular twigs may occasionally be
rersing it in front of its equatorial region. The aqueous
is filled by the aqueous humour, which is transparent, colour-
of such quantity as to preserve the proper curvature of the
thout causing tension, or allowing of laxity, and to keep it
from the iris by a considerable interval.
is varies in colour in different individuals; it is bright Iris.
nd marked by slight radiating ridges around the pupil; it
n health no appearance of blood-vessels. Its plane is exactly
the pupil, situated somewhat to the inner side of the centre
s, is perfectly circular, and dilates and contracts quickly with
of light.
amination of the *lachrymal apparatus* gives chiefly negative Lachrymal apparatus.
he position of the tear puncta closely in contact with the
junctiva must be noticed; pressure with the finger over the
sac causes no escape of fluid through the puncta, neither
chrymal gland be felt or seen in a normal condition of the

II. Examination by Lateral Illumination.

method all the parts mentioned above are seen more clearly, Examination by lateral illumination.
reign bodies, slight opacities of the cornea, &c., which might
ked in examining with the unaided eye, are discovered, and
n the whole of the lens and the anterior portion of the vitreous
satisfactorily be looked into.

The method of examination should be as follows:—The patient should be seated in a dark room (the pupil having been previously dilated with atropine), and a lamp placed at about two feet distance on the left, and rather in front of his face. The surgeon should stand nearly in front, or rather to the patient's right side, and facing him; he should then take in his right hand a biconvex lens of about two and a half inches' focal length,[1] and with it concentrate the light on the surface of the cornea; with a little manœuvring he will find that he can throw the light through the pupil to a considerable depth into the eye. The patient should be told to look in various directions, so that all parts of the anterior portion of the eye may be examined.

Results obtained.

The results obtained by lateral illumination are chiefly negative. The lens in health is perfectly transparent, and in youth is nearly colourless, but some bluish lines showing its division into different segments can be recognised by careful examination. As age advances, these lines become more marked, and the whole lens appears of a bluish-grey colour, though its transparency is still unaffected.

Behind the lens all appears dark, but any tumour, hæmorrhage, &c., occupying the anterior part of the vitreous would be discovered.

It should be noticed in the examination by lateral illumination that opacities of the cornea, &c., always appear with greatest distinctness on the side which is farthest from the light. A second lens may also be used to magnify the parts illuminated by means of the first.

III. Examination by the Ophthalmoscope.

Ophthalmoscope.

Description of the instrument.—The ophthalmoscope, as used at the present day, consists essentially of a mirror of silvered glass or polished metal, having a central opening, with certain accessory portions in the shape of convex lenses of different foci, used as objective lenses; clips and other contrivances for holding ocular lenses behind the sight-hole of the ophthalmoscope, together with the ocular lenses themselves. The ophthalmoscope since its introduction has undergone innumerable modifications, both in principle and detail; the number of different instruments now in use being nearly, or quite, as great as that of ophthalmic surgeons.

Liebreich's.

The most useful form of ophthalmoscope is that of Liebreich; the latest modification (Fig. 89) of this instrument consists of a silvered glass concave mirror of about eight inches' focal length, having a central opening in the silvering of a line and a half diameter. The mirror is fixed in a metal back, having a central perforation about double the diameter of the opening in the silvering. Upon the metal back is fixed a clip for the purpose of holding an ocular lens; the back is screwed to a handle about two and a quarter inches long. The accessory portions consist of two object lenses of two and a half and three inches' focal length respectively,[2] and five ocular lenses—two convex, of six and twelve inches positive foci;[3] three concave, of eight, twelve, and twenty-four inches negative foci;[4] all are made to fit into the above-mentioned clip. A very convenient case contains the whole

[1] A lens of two and a half inches' focal length is about equal to one of sixteen dioptrics in the metrical system.
[2] Sixteen and thirteen dioptrics, metrical system.
[3] About seven and three dioptrics, convex.
[4] About five, three, and one decimal five, dioptrics concave.

Method of using the ophthalmoscope.—There are two methods of using this instrument. The first, which requires much practice, is called the direct method of examination, or examination of the *erect image*, with the ophthalmoscope alone, without the aid of a bi-convex object lens.

The second, which is much the easier of the two, is called the indirect method, or examination of *the inverted image;* in it both the ophthalmoscope and a biconvex lens are used.

FIG. 89.



Examination of erect image.

Position lamp.

Liebreich's ophthalmoscope.

Direct ophthalmoscopic examination. — In this method a virtual erect image situated behind the eye is seen. The examination is conducted in the following manner:

The patient being seated in a dark room, a gas or other lamp (gas being preferable) should be placed at the side corresponding to the examined eye, on a level with it, but so situated as to leave the cornea in shade; he should then be directed to look forwards and a little upwards, at some distant object, and to keep the eyes as steady as possible.

Supposing the right eye to be examined, the lamp should be placed at the patient's right side; the observer standing in front at a distance of eighteen inches or two feet, should take the ophthalmoscope in his right hand, look through the sight-hole with the right eye, and reflect the light from the lamp through the pupil of the patient's right eye. If the examination be conducted properly, the pupil will appear of a bright red colour. The observer should then look for the optic disc, which is situated rather to the inner side of the axis of the eye-ball; he will know that the disc is in view from the alteration in colour of the pupil, which will turn from red to white, or pinkish white. Having obtained the peculiar reflection of the optic disc, the observer (taking care to relax his own accommodation) should approach the eye until an interval of only two inches separates his cornea from that of the examined eye. Some difficulty will be experienced in keeping the eye illuminated, increasing as the distance between the observed and the observer becomes less; this, however, will be overcome by practice. When the observed eye has been approached to within a distance of two to three inches (supposing both the examining and examined eye to be emmetropic), a distinct erect and greatly magnified image of the parts occupying the fundus of the latter should be obtained; most observers will, however, find the image sharpened in outline and detail by using a weak *concave* lens behind the sight-hole of the ophthalmoscope. Should either the observer or patient be myopic, it will be found necessary, in order to examine the erect image, to place behind the sight-hole of the ophthalmoscope a concave lens, which rather more than neutralises the existing ametropia.

Use of concave lens.

The examination of the erect image, although requiring considerably more practice than that of the inverted, should never be neglected, as it gives much more satisfactory evidence of minute changes in the fundus

Size of image.

oculi, all the parts being seen highly magnified (about 14½ times). It gives, however, a less extensive field of vision, on account of the size of the objects, which only allows small portions of them to be seen through the pupil at one time.

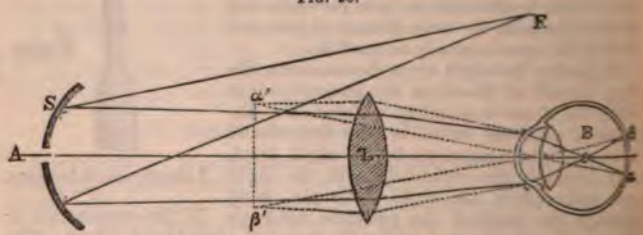
The optic disc, retinal vessels, and other parts occupying the fundus, should be examined by looking in different directions through the pupil; the observed eye being kept steadily fixed during the examination upon some distant and suitably situated object.

The right eye having been examined, the lamp should be placed on the patient's left side, and the manœuvre repeated; the observer using the left hand and left eye, instead of the right hand and right eye. The condition of refraction of the eye can be diagnosed by the direct method of examination.

Inverted image.

Indirect ophthalmoscopic examination.—In this method of examination an inverted aërial image of the fundus oculi is formed by the interposition of a biconvex lens between the observer and observed eye. (*See* Fig. 90.)

FIG. 90.



From Carter's translation of 'Zander on the Ophthalmoscope.' A. Observer's, B, observed eye. F. The light. S. The mirror. L. The biconvex lens. α β. Some portion of the retina, or the disc. α' β'. Its inverted aërial image formed between the mirror and biconvex lens.

Method of examination.

The position of the patient and observer should be the same as for the direct examination; the same lamp also can be used, but should be placed rather further back, and kept on the patient's left side during the examination of either eye. The ophthalmoscope should be held in the same manner and the light reflected through the pupil, as detailed above; but the red reflection having been obtained, the observer must not approach the eye, but remain at a distance of about eighteen inches.

The patient should be directed to look at some distant object, so situated that the axis of the observed eye is turned slightly inwards; this brings the optic disc (which lies somewhat to the inner side of the optic axis) opposite the ophthalmoscope, and its peculiar bright reflection will be at once observed.

The biconvex lens should then be held in front of the observed eye at a distance about equal to its own focal length from the cornea, and steadied by the observer resting his ring and little fingers on the patient's brow. By this means an inverted image of the optic disc and vessels of the retina is immediately seen, which, although apparently within the eye, is in reality formed in the air between the observer

and the biconvex lens, and (in emmetropia) at a distance from the latter corresponding to its focal length.

Position of image.

If the image of the disc appear indistinct, the observer may be sure that his own eye is not accommodated for the distance at which the image is situated, which is, in reality, shorter by some inches than it appears to be. Should this be the case, the observer must increase the tension of his accommodation, or withdraw somewhat further from the observed eye.

Use of convex ocular lens.

A better method, however, than either of the foregoing, is to employ habitually, behind the sight-hole of the ophthalmoscope, a convex ocular lens of about ten or twelve inches[1] focal length. If this be done, a clear and well-defined image will always be obtained without tension of accommodation, provided precautions be taken that the distance between the observer's eye and the image be *not greater than the focal length of the convex ocular lens.*

The disc and parts immediately surrounding having been examined, the patient should be directed to look straight forward, so as to bring the region of the yellow spot opposite the ophthalmoscope; this having been carefully examined, the eye should be turned upwards, downwards, to the right and left, so that all parts of the fundus may be examined in turn.

In the indirect method of examination the observer should use his right eye, and hold the ophthalmoscope in his right hand and the biconvex lens in his left in examination of the right eye, and *vice versâ* in examination of the left.

Difficulties of Ophthalmoscopic Examination.

Inconvenience from reflections of mirror.

Considerable practice is required in order to become proficient in the use of the ophthalmoscope; the beginner will be frequently much disheartened at his want of success. Some of the difficulties are only to be overcome by practice, others are easily remedied. Reflections of the mirror from the two surfaces of the object lens often prove very troublesome; the inconvenience arising from this source is obviated by holding the lens somewhat obliquely, when the two images will recede from each other, and leave a clear space between them. Reflection from the surface of the cornea may be troublesome, but can usually be overcome by a little manœuvring. Contraction of the pupil is also an insurmountable obstacle to the beginner, but can be removed by dilatation with atropine; for this purpose a solution of one grain to one ounce of water should be dropped into the eye about half an hour before the examination is made; or the patient may be ordered to use a solution of one eighth grain to one ounce two or three times on the day preceding it. When experience has been gained, however, atropine can be dispensed with, except in some few cases, or in those where it is necessary to make a very careful examination by lateral illumination.

How obviated.

Use of atropine.

If the patient be directed to look at a distant object the accommodation is relaxed, and sufficient increase in the pupillary area will generally take place.

Every ophthalmoscopic examination should be conducted on a certain definite system.

Systematic examination.

The first step should be to examine the condition of the refractive media by lateral illumination.

[1] *Four or three dioptrics.*

Next, the condition of refraction of the eye and the state of the vitreous chamber should be ascertained by the direct method of examination.

Thirdly, a general survey of the fundus oculi should be made by the indirect method.

And fourthly, any abnormalities having been discovered by the indirect examination should be fully and carefully studied in detail by the direct method.

If this systematic plan of examination be carefully carried out few mistakes will be made, and no abnormality of importance is likely to be overlooked.

Normal appearance of parts seen by the Ophthalmoscope.

Normal appearances.

The refractive media (cornea, aqueous humour, lens, and vitreous), as stated under Lateral Illumination, are perfectly transparent.

Retina.

The retina is either quite transparent and colourless, or in dark eyes may appear as a faintly grey cloud, covering the choroid; its position is marked by that of its blood-vessels. The bright red reflection previously mentioned is due to the blood in the choroid; the depth in colour of the reflection varies with the amount of pigmentation of this vascular tunic—in blue or grey eyes it is light red, in dark ones of a much deeper tint, and in the negro appears to be dark blue. The parts of the fundus oculi requiring special attention are the optic disc and parts immediately surrounding it, and the region of the yellow spot.

Cause of red reflection.

Optic disc.

The disc appears at first sight to be of an uniform pale pink colour, but on closer examination different portions are found to present different shades.

Its centre is pale, or even white; next to this succeeds a zone of pink, this being again bounded by an apparently double border of lighter colour. The pale appearance of the central portion of the disc is caused by connective tissue surrounding the blood-vessels in this situation. The succeeding pink zone consists entirely of nerve-fibres and delicate capillaries. The outer pale double border is formed by the margins of the sclerotic and choroidal rings, which do not accurately cover each other, the choroidal ring being somewhat greater in diameter than the sclerotic opening, the margin of which, being left uncovered by pigment, shines through the transparent nerve-fibres.

Peculiarities of optic disc.

Both the white central portion and the outer ring are in some cases so distinctly marked that the appearance produced might be taken by an inexperienced observer as evidence of disease, but both conditions are perfectly consistent with health. From the pale central portion of the disc proceed the retinal blood-vessels; these appear upon its surface usually at the same point, but may emerge separately or in groups of two or three.

Retinal vessels.

As a rule about eight vessels are seen, upon or close to the disc, four of these being arteries, with a corresponding number of veins; two each pass upwards and a like number downwards, to be distributed over the retina. The lateral branches are comparatively insignificant and are given off from the principal trunks, either upon the optic surface or in the retina near its margin.

Distinction between arteries and veins.

The veins are distinguished from the arteries by being of greater calibre, the proportion being about three to two. There is also

difference in colour between the two, the veins being the darker; the arteries are marked by a double contour, and their central portion is much lighter than their borders.

Occasionally a dark spot is noticed in one of the vessels at its origin or termination in the disc. This might be taken for a clot, but the appearance is caused by a peculiar arrangement of the vessel, which at this point is seen, as it were, on end and foreshortened.

Spontaneous pulsation of some of the retinal *veins* may also be observed; the occurrence of *venous* pulsation is, however, perfectly consistent with health, and has no pathological import. Spontaneous pulsation.

In any eye, pulsation, both arterial and venous, can be produced by pressure upon the globe, but should it occur spontaneously in the *arteries* has the gravest significance. (*See* Glaucoma.)

Anomalies of Optic Disc, &c., consistent with Health.

Certain phenomena are not unfrequently observed with the ophthalmoscope, which, although contrary to the condition usually met with, are perfectly consistent with a normal state of the parts.

The appearances caused by the connective tissue surrounding the central vessels, the occurrence of pulsation, unusual distribution, and existence of dark spots in the latter, together with the unusual distinctness of the sclerotic ring, have been already mentioned.

Other anomalies are:

1. *A dark crescentic* figure bordering some portion of the margin of the disc. This appearance is caused by a peculiar arrangement of the choroidal pigment; it is congenital. Dark crescent.

2. *Variations in depth of colour of the disc* are frequently met with. Due regard must be had to the colour of the surrounding fundus in forming an opinion as to whether the tint in any particular case is so much deepened or lessened as to constitute a diseased condition. Variations of colour.

In light eyes the disc appears much redder than in dark, the apparent difference being due more to contrast with the surrounding parts than to actual change in colour.

Slight deviations are only to be determined by careful examination and long experience.

3. *Excavation of the optic disc.*—Not unfrequently a sloping or even abrupt depression is met with occupying the centre of the disc, but usually extending somewhat further towards the yellow spot than in other directions. The whole nerve surface, however, is never included in the cup; the vessels do not bend under its edge, their calibre is not altered, neither is spontaneous arterial pulsation observed, as may be the case in the excavation of glaucoma. (*See* Glaucoma.) Excavation of disc.

4. *Persistence of the hyaloid artery.*—Occasionally a small whitish cord may be seen extending from the centre of the disc to the back of the lens; it is the remains of a vessel which, during fœtal life, nourished the latter structure. Hyaloid artery.

5. *Senile changes.*—As age advances, the refractive media become less transparent, the retina grows somewhat hazy, and the disc appears whiter than natural. Senile changes.

6. *An appearance of white wisp-like patches*, extending from some part of the margin of the disc over the surrounding fundus. These patches have irregular jagged borders, and are often of considerable size; the retinal vessels pass through and are obscured by them. Opacity of nerve fibres.

Occasionally white threads may be continued for a considerable distance along the sides of the vessels.

The patches are caused by the opaque nerve-sheaths which should end at the lamina cribrosa, being accidentally continued beyond this point into the transparent retina; they are congenital, and do not interfere with vision.

Choroidal vessels.

7. The choroidal vessels are at times (especially in light eyes) very plainly visible, appearing as an irregular network of pale pink bands.

Yellow spot.

The region of the yellow spot presents in health no very marked ophthalmoscopic signs, but requires special notice, as it is frequently the seat of pathological lesions. In the normal condition it is recognised by the absence of blood-vessels, which appear to avoid this part of the retina, and pass above and below it, by some deepening in colour, and occasionally an indistinct, dark, transversely oval figure can be detected.

IV. Examination by Manipulation.

The fourth method of examination, *by manipulation*, consists simply in ascertaining the tension of the globe by digital pressure. The examination should be conducted as follows:

Tension of globe.

The patient being directed to look downwards and close the eye gently, but not to screw up the lids, the surgeon should make gentle alternate pressure with the forefinger of each hand placed upon the closed upper lid; the pressure should be made in a direction backwards and somewhat downwards, so as to compress the globe against the floor of the orbit.

In health the eyeball is firm, tense, and semi-fluctuating; in disease the tension may deviate in the direction of increase or decrease. The degree of tension may be expressed as follows:

If normal, as Tn; if above par, as T+1, T+2, T+3, according to the amount of increase; if below par, as T−1, T−2, T−3. If a doubt exist, as T+ ? or T− ?, according as the doubt is on the side of increase or decrease.

REFRACTION, ACCOMMODATION, ACUTENESS, AND FIELD OF VISION.

Refraction.

Definition.—By refraction of the eye we understand the power which the refractive media (cornea, humours, and lens) possess by virtue of their curvatures and densities of bringing together parallel rays of light, and forming them into an image at a certain spot (known as the principal focus of the refractive or dioptric system), *without the employment of any adjusting power.*

The refraction is said to be *normal* or *abnormal* according to the position of the retina with regard to the focus of the dioptric system. The former condition is known as *emmetropia*, the latter as ametropia, the terms normal and abnormal being seldom applied.

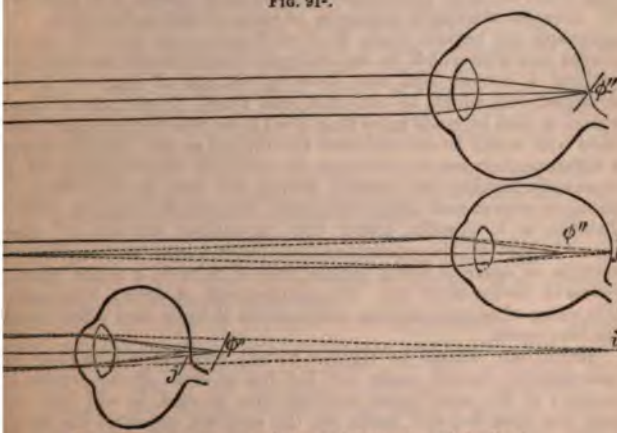
Emmetropia.

Emmetropia.—The emmetropic eye (Fig. 91*a*) is of such a shape that the retina is situated at the focus of the *dioptric system*, and in such a position that a distinct and inverted image of any object (the *rays of light proceeding from which are parallel*) is formed upon the layer of rods and cones.

Ametropia.—The ametropic eye differs from the emmetropic in two opposite directions; the deviations are known as *anomalies of refraction*. In the first and (in this country)[1] most commonly met with anomaly the retina lies *within* the focus of the dioptric system; that is to say, the axis of the eyeball is too short from before backwards; Hypermetropia. images of objects, the rays of light proceeding from which are parallel, are formed behind the retina instead of in its substance. This anomaly is known as *hypermetropia*, or far sight (*see* Fig. 91*c*). To the second anomaly an opposite state of things pertains; the axis of the eyeball from before backwards is too long, consequently the retina lies outside the focus of the dioptric system, and the image of an object, the rays of light coming from which are parallel, is Myopia. formed in front of it. This anomaly is known as *myopia*, or short sight (*see* Fig. 91*b*).

Ametropia.

FIG. 91[2].



From Donders, 'Accommodation and Refraction of the Eye.'
a. Emmetropia. *b*. Myopia. *c*. Hypermetropia.

The diagnosis of anomalies of refraction can be made by trial with lenses, by *direct* ophthalmoscopic examination, and by "keratoscopy." If we wish to diagnose and measure the degree of anomalies of refraction by trial with lenses we must be provided with a set of trial glasses and a book of Snellen's test types (*see* p. 360). The trial glasses which have now come very generally into use, are arranged according to what is known as the "metrical system." The unit in this system is a lens of one metre focal length; it is called a

Diagnosis of anomalies of refraction.

Metrical lenses.

[1] It is generally believed amongst English, and is also supported by continental Ophthalmologists, that in this country hypermetropia is of more frequent occurrence than myopia. It appears to me that the reverse may obtain. We are rarely in hospital practice consulted about slight myopia, as it gives no inconvenience. On the other hand, a very slight degree of hypermetropia may incapacitate the sempstress, skilled mechanic, or clerk, so that whereas we get all degrees of hypermetropia, we are only called to in the higher degrees of myopia.

[2] In these diagrams ϕ'' shows posterior focal points of the dioptric system—f in *b* and abnormal position of the retina.

Dioptric.

"dioptric" (=D). A lens of two dioptrics is double the strength of that of one dioptric, and has a focal length of half a metre (fifty centimètres), and so on. The box of trial glasses contains convex and concave spherical and cylindrical lenses. It can be obtained from any good optician.

Test of refraction by lenses.

Hypermetropia.

We test refraction with lenses as follows:—Having placed our patient at 6 metres from the sheet on which are printed letters from D=6[1] to D=60, we direct him to look towards it. Should he be hypermetropic he will be able to make out all or most of the letters; he will already have told us that he cannot see to do near work or read for any length of time without the eyes becoming fatigued and vision growing misty. We ascertain how many of the letters can be read by each eye separately. Should both eyes read the same letters, we hold before them convex glasses, beginning with +1 D, and continue the trial until we have ascertained *the strongest convex* lens with which the greatest attainable acuteness of vision is still maintained. Thus, supposing our patient reads D=6 at 6 metres, we find the strongest convex lens with which he can still read D=6; should he read D=12 without a convex lens, and D=6 by the aid of one, we find the strongest with which he can still read D=6; if we cannot improve vision, so that he reads more than D=12, we find the strongest convex glass with which he can still read D=12, and so on. Should there be a difference between the two eyes, we must test the refraction of each separately, keeping one covered during the trial of the other. The strongest convex lens which still allows the patient to see as well at a distance as is possible, either with or without the aid of glasses, shows a part of the accommodative power which he was obliged to exercise in order to bring parallel rays of light to a focus upon the retina of his too short eye. The employment of such a lens prevents this waste of accommodation, and reserves it to be used when required for near work.

Myopia.

Should our patient be myopic, he will probably tell us that he is near-sighted; he will make out but few or none of the letters at 6 metres; if the small types be given him to read, he will hold them near the eyes, but will make out the smallest, provided the book be held close enough.

We notice at what distance the small types can be read by each eye separately, and, as in hypermetropia, if there be no difference between the two test their refraction together.

We tell our patient to look towards the sheet on which are the letters from D=6 to D=60, and hold before his eyes concave lenses beginning with that the negative focal length of which corresponds to the distance at which small types are read.

Thus, if the small types can be read at twenty centimètres, we begin the trial with a lens of 5 D, the negative focal length of which is twenty centimètres.

We continue the trial until we have found the *weakest* concave lens with which distant letters can be most plainly seen. Should our patient by the aid of any concave lens be able to read D=6 at 6 metres we find the *weakest* with which D=6 can still be read. Should he

[1] The smaller letters D=5, D=4, D=3, &c., placed at their proper distances, will equally well if we have not a distance of 6 metres at disposal.

able only to make out D=24, D=12, &c., we must still find the weakest concave lens with which the best vision is attainable.

As in hypermetropia, should there be a difference between the two eyes, we test each eye separately.

We must be careful to ascertain *the weakest* lens with which the best vision for distant letters is attainable, because we wish only to so open out the pencil of parallel rays of light as to allow of their being brought to a focus in the retina of the too long eyeball.

If we give too strong a lens our patient will see equally well; but then we have opened out the pencil of parallel rays too much, and he must use his accommodative power in order to overcome the excessive divergence.

Diagnosis by the ophthalmoscope.

In the diagnosis and measurement of anomalies of refraction by direct ophthalmoscopic examination we act upon the same principle as in the diagnosis by trial with lenses; with this exception, however, that we use our own eye as a test, instead of the patient's vision.

As stated at p. 349, nothing of the details of the fundus of the emmetropic eye can be *clearly* made out until we have approached it very near. Now, on the contrary, should any object occupying the fundus be *clearly seen*, whilst we are still separated from the observed eye by a considerable interval, we may be certain that we have to deal with an anomaly of refraction.

Position of image.

The question now arises, Is the case one of hypermetropia or myopia? We answer the question by ascertaining whether the object we see is viewed in an erect or inverted position. If the former, the eye is hypermetropic, if the latter, it is myopic. We can ascertain the position of the image by moving our head from side to side. If the image be erect, it will move in the same, if inverted, in an opposite, direction to the movements of the head.

Measurement of degrees of ametropia by the ophthalmoscope.

If we wish to ascertain the amount of hypermetropia or myopia present, we take one of the ophthalmoscopes mentioned below; go as close as possible to the patient's eye, revolve the lens containing discs placed at the back of the instrument until we have ascertained, in hypermetropia, the strongest convex, in myopia, the weakest concave, lens with which we can still see clearly the optic disc and retinal vessels.

Expression of degree of ametropia.

The number of dioptrics of the strongest convex or weakest concave lens with which the greatest attainable acuteness of vision *for distant letters* is still maintained, expresses what is known as the degree of "ametropia." Thus, we say that an eye which sees as clearly or more clearly through a convex lens of two dioptrics has a hypermetropia of 2 D, an eye of which the acuteness of vision is most improved by a concave lens of three dioptrics has a myopia of 3 D, and so on.

The same holds good in the measurement of anomalies of refraction by the ophthalmoscope. The strongest convex lens in a case of hypermetropia, the weakest concave in one of myopia, through which a clear view of the fundus can still be obtained, expresses the degree of "ametropia" present.

Oldham's ophthalmoscope.

Two very useful ophthalmoscopes, by means of which anomalies of refraction can not only be diagnosed, but also accurately measured, have been devised, one (Fig. 92) by Mr. Charles J. Oldham, of Brighton (see 'Report of Fourth Ophthalmic Congress,' 1872), and another by

Mr. W. L. Purves; the latter is, I think, the more convenient of the two.[1]

The third method of ascertaining the form and also the degree of ametropia by "keratoscopy," is conducted as follows:—The patient being seated, and the lamp placed rather behind the level of the face, is directed to look straight forward. The observer should stand or sit

FIG. 92.



Oldham's ophthalmoscope.

at a distance of about a metre and a quarter, and with the ophthalmoscope reflect the light from the lamp upon the patient's eye. As soon as the bright red reflection of the fundus is seen the mirror should be rotated. If ametropia be present a shadow will be seen to pass across the illuminated area. The diagnosis of the anomaly present is decided by the direction of this shadow. If it passes in the same direction as the rotation of the mirror the eye is myopic; if in the opposite direction, the eye is hypermetropic.

In slight degrees of ametropia and emmetropia the shadow is so faint as to be made out with difficulty; if seen at all, it moves in the same direction as the mirror in slight M, slight H, and E.

We can ascertain the degree of anomaly present by finding in myopia the weakest concave lens which, held before the eye, makes the shadow begin to move against the mirror, in hypermetropia the strongest convex lens which causes the shadow to begin to move with the mirror.

[1] Many other refraction ophthalmoscopes are in use, but the two mentioned and another smaller and cheaper instrument, known as Loring's ophthalmoscope, will be found as useful as any.

ıe examination of refraction by keratoscopy it is well to have the
ıd accommodation fully under the influence of atropine or other
tic.
observer must be naturally emmetropic, or made so artificially.
TREATMENT of anomalies of refraction consists mainly in neu-
g the defect by suitable spherical lenses. We must, however, in
take care not to give too strong glasses.
further information on the subject of refraction the reader is
d to works treating specially of ophthalmic subjects, more espe-
o that on 'The Accommodation and Refraction of the Eye'
rs).

Accommodation.

ccommodation is meant the power which the eye possesses of Accommodation.
g the condition of its refractive media, so as to form upon the
images of near objects, the rays of light from which are diver-
qually as distinct as images of more distant ones, the rays of
om which are parallel, or nearly so.
power of accommodation depends upon the elasticity of the
line lens, the curvature of which can be increased to a consider-
tent; the alteration of curvature is brought about by the action
ıg of inorganic muscular fibres, situated between the sclerotic
oroid, just external to the greater circumference of the iris.
ng is known as the *ciliary muscle*. The manner in which the
muscle acts upon the lens is as yet a disputed point, one theory Ciliary muscle.
hat the lens is maintained in a flattened condition by tension
uspensory ligament so long as the eye is adjusted for a distant
that upon accommodation for a near one the ligament is re- Mechanicism of accommodation.
y contraction of the muscle, and the curvature of the lens
especially that of its anterior surface) increased by virtue of its
ısticity. The other theory is that the ciliary muscle compresses
s in some manner, and so alters its curvature.

Range of Accommodation.

speak of the range of accommodation, and by it we mean the Range of accommodation.
of a lens, which we suppose the crystalline adds to itself when
nge our look from the farthest to the nearest point of distinct
Thus, an eye which sees clearly at infinite distance, when its
nodation is relaxed, and at 16 centimètres with greatest tension
mmodation, has a range or "amplitude" of accommodation equal
ıs of $\frac{100}{16} = 6$ D about.
mmodation is accompanied by convergence of the optic axes
ıe action of the internal recti muscles and by contraction of the

Diseases of Accommodation.

lysis of accommodation is met with in cases of paralysis of the Paralysis of accommodation.
erve, accompanied by ptosis, divergent strabismus, and more or
ıtation of the pupil; it may be caused by injuries, as blows on
ball itself or in its vicinity; sometimes it is met with without
ıt cause, not unfrequently in persons recovering from diph-
or from any exhausting disease, and accompanied by no paralysis
external ocular muscles; it can always be produced artificially
ıse of atropine or other mydriatics.

Symptoms.—Dilatation of the pupil, general mistiness of vision, and inability to see near objects plainly, the last condition being capable of correction by the use of a convex lens.

TREATMENT.—This depends on the cause; if the paralysis of accommodation be associated with paralysis of other branches of the third nerve, the treatment must be directed against any existing constitutional condition—syphilis, rheumatism, &c.—most improvement being brought about by the use of iodide of potassium in increasing doses, alone or in conjunction with bichloride of mercury. If dependent on injury, the eye should be kept bound up, and inflammatory symptoms treated as they arise. If arising idiopathically, without apparent cause, a solution of sulphate of eserine should be used two or three times a day in order to stimulate the ciliary muscle to contract, and attention paid to the general health. In any case a convex lens may be used if required.

Spasm of accommodation.

Spasm of accommodation is met with in some cases of hypermetropia, and occasionally in myopia; it often masks a considerable amount of hypermetropia, and may at times even make the eye appear to be myopic. If it exists with myopia, the degree of short sight is increased.

Symptoms.—Severe and constant pain in the eyeballs and forehead, increased on any attempt to use the eyes, and associated with some anomaly of refraction (generally hypermetropia), inability to see near or distant objects distinctly, these symptoms being modified or entirely removed by the use of atropine.

TREATMENT.—Paralyse the accommodation by the constant use of a strong solution of atropine (gr. iv. of sulphate of atropia to ℥j of water), and accurately neutralise any existing anomaly of refraction by suitable lenses.

Acuteness of Vision.

By acuteness of vision we understand the perceptive and conductive power of the structures concerned in sight; this may be ascertained by the use of test types; *i.e.*, letters of certain definite proportions which can be recognised by a fairly sharp-sighted eye at certain distances, which distances are marked over each set of letters.

Snellen's types.

The book of test types we use is that of Dr. Snellen; in it we find types variously numbered from ·5 to 60, the former being ·5 of a metre, or 50 centimètres, the latter 60 metres, at which distances the types can be read by an emmetropic eye of normally acute vision. The book of types can be obtained of Williams and Norgate, Henrietta Street, Covent Garden.

Field of Vision.

Field of vision.

By the field of vision we understand the area over which objects situated in the same vertical plane can be distinguished, the eye being kept fixed on some point. The limits of the field of vision are marked by the most eccentrically placed points of objects, which can still be distinguished, the direction of the visual axis of the eye being unaltered.

Examination of field of vision.

Mode of ascertaining the extent of the visual field.—The extent of the visual field is easily measured by either of the two following methods:

1. The patient being placed at a distance of twelve inches from a

black board about three feet square, having a white cross in the centre, should be directed to look steadily at the cross, which must be situated on a level with the eyes; one eye being closed, the sensibility of the retina of the other should be tested by moving a piece of chalk fixed on a dark handle from all directions towards the cross, a mark being made at the point where the chalk first becomes visible. With black board.

The whole area limited excentrically by a line joining the points at which the chalk is first seen when approaching from every direction is known as the *quantitative field* of vision, in contra-distinction to an area bounded excentrically by much narrower limits, over which objects are distinctly defined, and letters can be read, &c., known as *the qualitative field of vision.*

2. Another very simple and effectual method of investigating the condition of the visual field is conducted as follows:

Having placed the patient in a convenient position, we stand opposite to him, at a distance of about two feet, and, supposing his left eye to be examined, we direct him to look steadily at our right eye, which is opposite to his left; the patient's right eye and our left being kept closed, we then move our hand in various directions in the peripheral parts of the field, and notice if its movements are perceived by the patient at the same distance from the centre as by our own healthy retina. By comparison with healthy eye.

Care must be taken that the hand is moved in a vertical plane situated midway between our own and the patient's eye, and not nearer one than the other; we must also take care that he keeps his eye fixed.

Supposing that the eye under examination distinguishes all movements of the hand at the same distance from the centre as our own, we decide that his field of vision is normal; but if a falling off is noticed in any particular direction, we infer that the sensibility of the corresponding portion of retina is impaired. Normal extent of field.

It must be remembered that each part of the visual field corresponds to a part of the retina opposite to, and not on the same side as, the object seen; *e.g.*, suppose that the movements of the hand are not perceived in the outer half of the field, the inner half of the retina is defective, and *vice versâ*.

It must also be borne in mind that the height of the bridge of the nose has a considerable influence in limiting the inner half of the visual field. Limitation or contraction of the visual field is a very constant accompaniment of retinal changes; it is also one of the earliest symptoms of glaucoma, and occurs as a physiological condition with advancing age. Limitation of field of vision.

Stereoscopic test for the retina.—A very simple and effectual method of testing the sensibility of the retina has been devised by Mr. Joseph Towne, of Guy's Hospital: it consists in presenting simultaneously to non-corresponding halves of the two retinæ similar objects. Towne's stereoscopic test for the retina.

The examination is carried out by means of a stereoscope, provided with two slides; on each slide are two white semicircles described upon a red ground, those on the one slide being so contrived that when looked at through the stereoscope they correspond to the nasal halves of the two retinæ, whilst those on the other slide correspond to the two malar halves. In cases of want of sensibility of the whole or any part of the retina, from whatever cause arising, a part or the

n connection with severe inflammation of neighbouring
rulent ophthalmia. The swelling and redness are usually
and the eye cannot be opened; the inflammation generally
ution, but may (especially if it result from measles, scar-
o on to the formation of abscess, or even to sloughing of

T.—Locally, fomentations with hot water or decoction of
if an abscess form, it should be opened—preferably
conjunctiva.
t's general health should also be attended to.

deolum") is a small red and painful swelling situated on Stye.
face of the lid, or near its margin, and consists in a
l inflammation of the lid, dependent on morbid change in
an glands. Styes generally occur in weakly, delicate
ral may appear simultaneously, or there may be a suc-
em; they give rise to considerable irritation, and are
ely painful. The inflammation usually goes on to

T.—Fomentations, poultices, the administration of tonics,
ng. When pus has formed, the little tumours should be

thalmia tarsi). Tinea.
ffering from tinea present themselves with yellowish-
usts hanging to the eyelashes, which have often dropped
derable extent.

s the margins of the lids are much thickened, giving rise Displacement
nt of the lower tear punctum, and consequent watering of tear
On removing the crusts the margin of lid will be found puncta.
ured, and easily bleeding. The disease consists in inflam-
ulceration about the roots of the lashes; it runs a very
e, often lasting for years in spite of remedies.

T.—Slight cases can generally be cured by the use of a
ing 4 to 6 grains of alum to the ounce of a water, applied
times a day, and of mild nitrate of mercury ointment
the ordinary nitrate of mercury ointment to eleven of
d along the margins of the lids night and morning.
t should be directed to remove all the crusts before
ointment.

e cases should be treated by pulling out the lashes and
scabs with forceps, and then applying solid nitrate of
aw surface left.

here the lower tear punctum has become everted the
canaliculus must be slit up. (*See* p. 405.)

Wounds of the eyelids, however extensive or ragged, Wounds.
having been thoroughly cleansed, be brought accurately
y will usually heal readily enough. Should there be any
nce, an endeavour must be made to prevent distortion of
ntraction of the resulting cicatrix.

of the lids (black eye) frequently occurs as the result of Ecchymosis.
ay be caused by leech-bites or operations.

T.—Most cases may be left alone, but if it is desirable to

ts employed in the ophthalmic department at Guy's Hospital are now prepared with vaseline instead of lard.

get quickly rid of the effused blood, a poultice made of equal parts of the scraped root of black bryony and bread crumbs should be applied. The poultice should be kept on as long as the patient can bear it. The application is often accompanied by a good deal of stinging pain.

Emphysema. **Emphysema** of the lids sometimes occurs from rupture of the mucous membrane of the nose, air being forced into the cellular tissue of the eyelids, on sneezing, or blowing the nose. Gentle pressure with cotton wool and a bandage, and avoidance of violent expiratory movements, sneezing, &c., is the only treatment required.

Lachrymal apparatus. **The lachrymal apparatus.**—The principal affections of the tear passages, &c., will be described in the next section.

THE CONJUNCTIVA.

Ophthalmia. **Ophthalmia.**—Under this head are collected all the different forms of inflammation of the conjunctiva. The following characters are common to all: more or less vascularity of the membrane, uneasiness and stiffness of the lids, pain of a smarting character, some kind of discharge, and gumming together of the lids during sleep.

Characteristics.

Inflammation of the conjunctiva has to be distinguished from inflammation of the sclerotic or subconjunctival fascia, or the injection of these structures which is present in many of the inflammations of deeper parts of the globe. The distinction can be made by paying attention to the following points:

Diagnosis. 1. The inflamed conjunctiva is bright red, the vessels are large and tortuous, and anastomose freely, forming a dense network; they are of greater calibre about the fornix, and taper off towards the cornea.

The inflamed sclerotic or episcleral tissue is pinkish or bluish in colour; the vessels are small and straight, and the vascularity is usually most marked in a ring around the eyeball, just external to the corneal margin.

2. The vessels of the conjunctiva can be somewhat displaced, and made to glide over the surface of the eyeball by gentle pressure; those situated in deeper parts cannot be made to alter their positions.

3. The pain in inflammation of the conjunctiva is of a smarting character; while in inflammations of deeper parts it is dull and aching and often very severe.

Treatment. TREATMENT.—Inflammations of the conjunctiva are best treated by astringent applications.

Any of the following formulæ may be employed;

Astringent applications.

Strong Alum Lotion.

Alum, gr. x; water, ℥j.

Useful in cases of purulent ophthalmia.

Alum Lotion.

Alum, grs. iv to vj; water, ℥j.

Sulphate of Copper Drops.

Sulphate of copper, gr. ij; water, ℥j.

Sulphate of Zinc Drops.

Sulphate of zinc, gr. ij; water, ℥j.

Nitrate of Silver Drops.
Nitrate of silver, gr. j; water, ʒj.
Chloride of Zinc Drops,
Chloride of zinc, gr. ij; water, ʒj.
Most useful in cases of chronic ophthalmia.

Atropine and Astringent solution.
Sulphate of atropia, gr. ½ to gr. ij; Sulphate or chloride of zinc, gr. ij; water, ʒj.
Useful in cases where iritis or corneitis occur in the course of ophthalmia.

Antiseptic Lotion.
Boracic acid, gr. xv; water, ʒj.
Useful in purulent ophthalmia and sloughy ulceration of the cornea.

Any of these remedies may be given to the patient to use himself; they should be applied from three to six times a day, or oftener, and the patient should be directed to wash away all discharge before using any of them, and to take care that the lotion goes well between the lids.

Some kind of ointment (spermaceti, mild nitrate of mercury, &c.) should also be ordered to be smeared on the margins of the lids at night, to prevent their becoming gummed together during sleep.

The condition of the patient's general health should also be attended to.

Other applications, which should be used by the surgeon himself, are—

The mitigated nitrate of silver stick (consisting of nitrate of potash and nitrate of silver, in the proportion of three parts of the former to one of the latter.—*Green stone—lapis divinus* (consisting of equal parts of alum, nitrate of potash, and sulphate of copper, with a small quantity of camphor), and *solid nitrate of silver.* In order to apply any of these the patient should be seated in a chair, and the Surgeon standing behind, as in Fig. 93, p. 396; should evert the lids and lightly rub their conjunctival surface with either. If a preparation of nitrate of silver be employed, the conjunctiva should be washed with salt and water immediately after the application.

Mitigated nitrate of silver stick. Green stone.

Application of green stone, &c.

Varieties of Ophthalmia.

Catarrhal ophthalmia is commonly caused by draughts of cold air is highly contagious, and acute in its course.

Catarrhal ophthalmia.

The conjunctiva, both ocular and palpebral, is highly injected, and sometimes swollen; there may be small extravasations of blood in the structure of the former; there is a thick, yellow, tenacious discharge.

One or both eyes may be affected, the disease usually commencing in one, and spreading to the other in the course of two or three days.

TREATMENT in the early stages, before there is any amount of discharge.—Some soothing application (as decoction of poppy-heads) should be employed; later on, an astringent should be used, and some mild nitrate of mercury or spermaceti ointment smeared on the edges

of the lids at bed-time, to prevent their becoming gummed together during sleep.

The patient (or, in the case of a child, its parents) should be warned of the contagious nature of the disease, and no sponges, towels, &c., which he is in the habit of using, should be used by other people. Among the poorer classes it is very common to see a whole family suffering from catarrhal ophthalmia.

Chronic ophthalmia.

Chronic ophthalmia is usually a sequel of some more acute form; the palpebral conjunctiva is reddened, the ocular conjunctiva presenting patches of slightly increased vascularity, but no general redness, as in cases of catarrhal ophthalmia; the lids are often somewhat thickened, and the caruncle and semilunar fold swollen. There is slight mucous discharge, which forms dry crusts on the margins of the lids, and, at the inner canthus, overflow of tears may occur from obstruction or displacement of the tear puncta.

TREATMENT, the same as that of catarrhal ophthalmia. The disease may continue for almost any time, and when one remedy appears to have lost its effect another should be tried.

Phlyctenular ophthalmia.

Phlyctenular ophthalmia, usually met with in children and young adults, especially females, is characterised by the existence of small whitish elevations on the conjunctiva, most commonly near the margin of the cornea; each little elevation has a wisp of blood-vessels leading to it if near the corneal margin, and is surrounded by a zone of vascularity if situated in any other part of the conjunctiva. There is some watering of the eye and slight mucous discharge.

Patients are frequently met with who suffer from repeated attacks of phlyctenular ophthalmia.

TREATMENT.—In treating phlyctenular ophthalmia our object is to set up a certain amount of irritation of the conjunctiva, by which the phlyctenulæ will be destroyed. This can be attained by dusting calomel into the eye daily, or by ordering a small quantity of an ointment containing 2 grs. of yellow oxide of mercury to ʒj of lard or vaseline, to be applied to the inner surface of the lower lid at bed-time. Either of these remedies will soon cause the phlyctenulæ to disappear. The disease, as affecting the conjunctiva covering the cornea, will be spoken of under diseases of that structure. Tonics should be given if required.

Yellow oxide of mercury ointment.

Granular ophthalmia.

Granular ophthalmia.—This disease occurs at all ages, and is very common amongst the lower classes, especially the Irish; it is highly contagious. Granular ophthalmia is often very prevalent where large numbers of persons are crowded together in workhouses, parish schools, barracks, &c. It would appear that in those who have lived for a considerable time under unfavorable hygienic conditions, a peculiar granular state of the palpebral conjunctiva becomes developed. Persons thus affected are said to be predisposed to granular ophthalmia. The predisposed eyelid is characterised by the existence of small pale spherical bodies, situated in the structure of the conjunctiva; the little bodies much resemble and are known as sago grains; they are most constantly found upon the lower lid near the outer canthus.

Predisposed eyelid.

This predisposed or granular condition of the eyelids may remain stationary for an unlimited time without giving rise to inconvenience; but on the other hand, attacks of inflammation are ever liable to be

ng rise to the development of granular ophthalmia as we
ctice.
with three principal forms of granular ophthalmia, which
inguished from each other by the nature of the granulations

acterised by the predominance of the sago grains already
around which inflammation has been set up, is known as
anulation.
form, characterised by the predominance of hypertrophied Follicular granulations.
which the sago grains if they exist are obscured, is known
granulation. A third form, characterised by a mixture of Papillary granulations.
anulations and hypertrophied papillæ, is known as mixed Mixed granulation.
; this is the most severe form of the three.
es, and especially those that have been treated by strong
e conjunctiva may be found converted into a mass of rough
rices, and its secreting power destroyed, the condition
xerophthalmia" being developed.
ions in active granular ophthalmia, unlike the sago grains Xeroph-thalmia.
acterise the predisposed lid, are always found most de-
the conjunctiva covering the attached border of the tarsal
the upper lid. Their appearance is more or less altered
nt; they are accompanied by thick yellow discharge, and
e more or less severe intolerance of light.
f granular ophthalmia.—The cornea may become more or Sequelæ.
and vascular, especially at its upper part; the condition
s "pannus," and is caused by constant irritation of the Pannus.
ne rough surface of the lid.
unctiva may be destroyed to a greater or less degree, Destruction of conjunctiva.
icatrices being formed, which, by their contraction, cause
the membrane and distortion of the lids, giving rise to
nd narrowing of the palpebral aperture. The hair bulbs Entropion.
e displaced, causing the eyelashes to be misdirected—
(see p. 399). The results of granular ophthalmia are Trichiasis.
ggravated by unskilful treatment.
NT.—In treating granular ophthalmia our object is to Treatment.
granulations, with as little damage as possible to the
itself.
f strong caustics must be carefully avoided, as they cause Avoidance of strong caustics.
struction of tissue, followed by the formation and subse-
uction of cicatrices.
es can be cured in a short time by the application of miti-
e of silver stick twice a week, or oftener, and the use of
copper drops from three to six times a day.
re cases will remain under treatment for months or years, Duration of attack.
vered with will improve greatly and may ultimately recover.
almia be of recent date the granulations should be touched
with the mitigated nitrate of silver stick, or, if possible,
ulphate of copper drops being used from three to six times

cases the green stone should be used instead of the nitrate
k.
cation of calomel powder or quinine to the granulations
n found useful in some cases.

Inoculation.

When the cornea is completely opaque and fleshy looking, inoculation with pus from a case of purulent ophthalmia may be tried, but only in extreme cases, otherwise we may do more harm than good by causing sloughing of the cornea; should but one eye be affected, care must be taken to prevent the other becoming inoculated.

Occurrence of iritis.

Iritis not unfrequently supervenes in the course of granular ophthalmia; when it occurs a solution of atropine should be dropped into the eye from three to six times daily, in addition to other remedies.

Pannus requires no special treatment, and if not very dense disappears as the granulations are cured. In all cases some simple ointment should be applied to the edges of the lids at night, to prevent their becoming gummed together.

Purulent ophthalmia.

Purulent ophthalmia.—Purulent ophthalmia may be met with, as "ophthalmia neonatorum" in children soon after birth, or in older persons. In the former case it may be caused by contact of acrid vaginal secretions, by want of cleanliness and fresh air, or a combination of the two; in the latter by contact with some form of specific pus, or by constant irritation of the already inflamed conjunctiva. It is highly contagious.

Gonorrhœal ophthalmia. Ophthalmia neonatorum.

The worst form of the disease, whether occurring in infants or older persons, is that caused by inoculation with gonorrhœal matter—"gonorrhœal ophthalmia."

"Ophthalmia neonatorum" makes its appearance a few days after birth; the eyelids are found red or bluish-red and swollen; the eyes can only be opened with difficulty, and on attempting to separate the lids thick yellow purulent discharge escapes from between their edges; both eyes are almost always affected.

Purulent ophthalmia in older persons may affect one or both eyes: it commences with intolerance of light, lachrymation, and injection of the conjunctiva, at first much resembling an ordinary attack of catarrhal ophthalmia, but in about twelve to twenty-four hours its real nature becomes apparent by thick yellow discharge from between the swollen, red, and sometimes everted lids. The conjunctiva is bright scarlet, traversed by large distended blood-vessels, and much

Chemosis.

swollen, especially the ocular portion (chemosis), which may overlap the cornea and protrude in folds between the lids; there is pain and intolerance of light; and there may be much depression, especially if the attack have lasted long. The patient may be suffering from gonorrhœa. The great danger to be feared in purulent ophthalmia is implication of

Implication of cornea.

the cornea, which may be partially or entirely destroyed by suppuration or sloughing.

Treatment.

Treatment.—In all cases the patients themselves or their parents should be warned of the contagious nature of the disease, and if one eye only be affected, the greatest care should be taken to protect the other. If possible, a good view of the cornea should be obtained, as its condition materially influences the prognosis with regard to sight. The examination should be made with care, as the cornea may be ruptured whilst making it.

In ophthalmia neonatorum the only treatment required is to wash out the eyes every hour or half hour with strong alum lotion (p. 364) until the discharge is lessened; the lotion need only be used thus frequently for twelve hours out of twenty-four (from 8 a.m. to 8 p.m.), the child being allowed to sleep at night; as the discharge is

ss the lotion may be used less frequently. Some simple ointment ıould be applied to the margin of the lids once or twice a day to keep ıem from sticking together.

Slight cases of purulent ophthalmia in older persons may be treated the same manner, but the more severe forms (especially the ıorrhœal) require that much more energetic measures be taken.

The treatment should be both local and constitutional.

Local treatment.—When the patient is first seen the lids should everted, and the whole conjunctiva brushed over with a stick of lid nitrate of silver, or painted with a solution of 40 to 60 grains of e salt to ℥j of water; the application should be repeated in the course two or three days if no improvement have taken place. The patient ould be kept lying down in a dark room, and a bag of ice, or lint pt wetted with ice water, applied over the closed lids; the ice or t should be removed and the eyes washed out every hour or half ur with some astringent or antiseptic lotion, the greatest cleanliness ing observed. Application of nitrate of silver.

Should there be much pain, and the patient be strong, blood may taken from the temples by leeches or the application of the arti- ial leech, but, as before stated, most patients suffering from ere purulent ophthalmia are much depressed and will not bear pletion. Abstraction of blood.

Constitutional treatment.—The free administration of tonics, es- cially iron and quinine, with good living, and a fair amount of mulants. Constitutional treatment.

If perforation of the cornea threaten or have taken place, the eye ould be kept firmly bandaged, so as to prevent as much as possible y escape of the contents of the globe.

Diphtheritic ophthalmia.—This form of ophthalmia is but rarely ct with in London; it affects persons of all ages. At first sight e case appears to be one of severe purulent ophthalmia; its chief aracteristic, however, is a solid infiltration of the substance of the njunctiva, with or without the formation of diphtheritic membranes its surface. The affected eye is frequently lost from implication of e cornea. The disease is best treated by sedative applications, as mentations of poppy heads, or belladonna, attention being paid to e patient's general health. Diphtheritic ophthalmia.

Injuries.—Wounds of the conjunctiva usually heal readily enough, quiring only simple treatment. Injuries.

Burns are usually caused by contact of lime or hot metals; the mage done may be only slight, or the whole conjunctiva and cornea ay be converted into a dead white slough. Burns.

TREATMENT.—The conjunctiva should be carefully examined, and l foreign bodies and portions of sloughy tissue removed; should e injury have been caused by lime the surface of the conjunctiva ust be carefully cleansed with a weak solution of acetic acid or mple warm water. Some oil should be placed between the lids, and e eye bound up with wet lint and a bandage. If any symptoms of itis appear, a solution of atropine should be dropped into the eye om three to six times a day. Should there be much discharge alum tion may be used. Treatment.

When the sloughs have separated, care must be taken to prevent hesions between the raw surfaces left, by passing a probe between Prevention of adhesions.

Hæmorrhage.

Hæmorrhage into the substance of the conjunctiva or beneath it may occur spontaneously, or from injury; no treatment is necessary, the patient may be assured that no harm will come of it, and the blood will disappear in the course of a week or longer.

External muscles.

EXTERNAL MUSCLES OF THE EYEBALL.

Strabismus will be considered in the next section.

Nystagmus.

Nystagmus signifies a peculiar involuntary quivering motion of both eyes, dependent on rapid contraction of antagonistic pairs of muscles. The disease is usually developed in infancy, and is frequently associated with considerable impairment of vision, arising from congenital cataract, opacity of the cornea after purulent ophthalmia, atrophy of choroid, &c. Nystagmus occurs in some nervous diseases, as locomotar ataxy; also in persons who work in bad light, as those employed in mines, when it is described as "miners' nystagmus."

Treatment.

TREATMENT.—Nothing can be done to remedy nystagmus in the first classes of cases. But miners' nystagmus may be entirely cured by removing the patient from his work and the administration of tonics.

Paralysis and paresis.

Paralysis and paresis.

Paralysis signifies total loss of power of the affected muscle; paresis only partial loss.

Symptoms.

The symptoms of paralysis and paresis are double vision and loss or impairment of mobility of the eye in some particular direction.

The causes are affections of the brain or spinal cord; diseases of the orbit, as tumours, nodes, or inflammatory exudations, pressure on the nerves supplying the muscles, and affections of the muscles themselves or of the muscles. As a rule, the cause of the paralysis or paresis can only be conjectured, but very many cases will be found connected with syphilis.

Treatment.

TREATMENT.—A careful inquiry should be made into the patient's previous history, and remedies given in accordance with this, usually an antisyphilitic nature being generally required. If the affection has not lasted more than three months a favorable prognosis may be given, but if, on the contrary, it has existed six months or more, recovery is very improbable.

Paralysis of all the external muscles of the eye, "ophthalmoplegia externa" (Hutchinson), is occasionally met with. The eye looks straight forwards and is almost immovable, there is partial ptosis.

The disease is probably of syphilitic origin, but is little influenced by treatment; it is often associated with symptoms of serious cerebral disease.

Insufficiency of internal recti.

Insufficiency of the internal recti muscles gives rise to some obscure symptoms, which have been mistaken for manifestations of cerebral disease.

Patients thus affected complain that they cannot do near work for any length of time, as objects looked at become indistinct, or appear double. They suffer from giddiness, and pain in the brows and head.

nerally. Insufficiency of the internal recti should always be sus-
cted if in a case of hypermetropia relief cannot be given by the use
glasses.

TREATMENT.—Any anomaly of refraction should be accurately Treatment.
utralized, and the weakened muscles assisted by the use of prisms
of spherical lenses so arranged as to have a prismatic action.

THE CORNEA.

Inflammation (corneitis, or keratitis).—Five different forms of in- Corneitis.
mmation of the cornea are met with:—(1) Simple corneitis, (2)
erstitial or parenchymatous corneitis, (3) pustular corneitis, (4)
eratitis punctata, (5) corneitis with sloughing or suppuration.

Symptoms.—Corneitis is characterised by watering of the eye, im- Symptoms.
rment of vision, intolerance of light, and pain, at times severe, at
ers insignificant; on examination more or less of the cornea will be
nd cloudy or quite opaque, and blood-vessels may be seen in its
stance or on its surface.

It is of importance to notice the course and position of the blood- Diagnosis.
sels in any case where the cornea has become vascular. Should
vessels lie altogether in the cornea, commencing near its margin,
l passing for a variable distance in its substance, the case is pro-
ly one of interstitial keratitis; but should the vessels be continuous
h those of the conjunctiva, pass over the margin of the cornea,
l lie superficially on its surface, the vascularity is probably due to
chanical irritation from granular lids or inverted lashes, and the
dition known as *pannus* is present.

It is very necessary that the difference between these two forms of
cularity should be recognised, as their treatment varies widely.
In the former case the treatment of keratitis, to be presently de-
ibed, should be adopted; in the latter treatment must be directed
inst the cause of the vascularity (granular lids, &c.).

Simple corneitis may be caused by injuries, or the lodgment of Simple
eign bodies on the surface or in the substance of the cornea. There corneitis.
some pain, intolerance of light, and lachrymation, and some part
the cornea is found occupied by a halo of dulness.

Interstitial or parenchymatous keratitis (corneo-iritis, syphilitic Interstitial
ratitis, keratitis, diffuse keratitis, vascular corneitis). keratitis.

Interstitial keratitis occurs as a rule in persons who are affected by
reditary syphilis; it is frequently but by no means invariably asso-
ted with changes in the teeth, pegged canines, notched incisors,
dome shape of first molars; flattened nose, fissures around the
gles of the mouth, or other manifestations of congenital syphilitic
ease.

It usually first makes its appearance between the fifth and eighteenth
ars, but has been seen as late as thirty; it always affects both eyes,
ther simultaneously or at short intervals; it runs a very chronic
rse and is most intractable, a severe attack often lasting from twelve
eighteen months.

Symptoms.—Interstitial keratitis presents all the symptoms of in- Symptoms.
mmation of the cornea in a marked degree. The opacity is peculiar,
is caused by infiltration of the substance of the cornea with opaque
erial.

At first the cornea becomes spotted in its centre, but the spots soon run together, forming a greyish haze; opacity then commences at the upper and lower corneal margins, and gradually spreads, until the whole structure resembles somewhat a piece of ground glass, apparently blood-stained in parts, from the development of innumerable minute blood-vessels. There is always a well-marked band of ciliary injection. Interstitial keratitis is not unfrequently complicated by iritis, hence the name "corneo-iritis."

Recovery.

The opacity having reached a certain point, may remain stationary for months, but at length clearing commences, and the cornea regains more or less of its normal transparency; recovery always taking place to a much greater extent than would be at first expected. In some few cases a choroido-iritis is set up, and the eye eventually shrinks.

Pustular corneitis.

Pustular corneitis (phlyctenular, strumous, vascular, corneitis; strumous ophthalmia, fascicular keratitis).

Pustular corneitis is met with in children and young adults; it often follows measles, scarlatina, or other acute diseases; it is frequently accompanied by eczematous eruptions on the eyelids, about the nostrils and angles of the mouth, and on the head; the patients often present well-marked strumous diathesis, and are generally said to be delicate.

Symptoms.

Symptoms.—In most cases there is profuse lachrymation, accompanied by great intolerance of light; the lids may be swollen, covered with eczematous eruption, and tightly screwed up, so as to cause the greatest difficulty in examination.

There is more or less injection of the ciliary region (ciliary redness). Upon the surface of the cornea may be found (1) small greyish elevations (phlyctenulæ); (2) phlyctenulæ in a state of suppuration (pustules); (3) small ulcers left on discharge of the contents of the latter. Any of these are usually found in greatest quantity round the margin of the cornea, but its whole surface may be found dotted over with phlyctenulæ, pustules, or ulcers, or examples of all three may be met with in the same eye. There is more or less haziness and vascularity surrounding the affected portions of cornea. In some cases there is thick mucous or muco-purulent discharge in addition to the lachrymation.

Cases of pustular corneitis, accompanied by great intolerance of light, much swelling of the eyelids, profuse lachrymation, and thick muco-purulent discharge, occurring in strumous children, are sometimes described as a separate disease under the name of "strumous ophthalmia."

Strumous ophthalmia.

Fascicular keratitis.

Fascicular keratitis is a somewhat rare form of the disease characterised by the existence of a fasciculus of vessels running on to the cornea from its margin, the fasciculus terminating in a small ulcer, phlyctenula, pustule, or small inflamed patch of cornea.

Pustular corneitis is very likely to recur.

Keratitis punctata.

Keratitis punctata occurs, as a rule, in young adults, rarely in children, but may be met with at all ages, as a part of sympathetic ophthalmia; it much resembles the early stages of interstitial keratitis, and probably arises from the same cause; as a rule, one eye only is affected; there are the usual symptoms of corneitis, but the intolerance of light is not very severe; the cornea is dotted over with small greyish opacities, which are collected most thickly in its central portion, and

ful examination will be found to occupy the posterior layers of
ructure. The disease is most intractable, and may be accom-
by iritis.

eitis with sloughing or suppuration is usually the result of sharp Suppur
as flicks from twigs, &c., or is caused by the irritation of foreign corneiti
as the husks of corn; it may also occur after operations for
t.

ptoms.—Those of corneitis, severe pain being, as a rule, one of the
arked; some part of the cornea will be found occupied by a collec-
pus, part of which may have escaped into the anterior chamber
llected at its lower part, giving rise to the condition known as
pyon;" or the pus may have gravitated down between the layers Hypopyon.
cornea to its lower margin, forming a collection much resembling
yon, and known as "onyx." Suppurative corneitis is met with Onyx.
s of *neuro-paralytic ophthalmia;* a peculiar form of inflamma- Neuro-
ssociated with paralysis of the ophthalmic division of the fifth paralytic
and consequent anæsthesia of the parts supplied by it. ophthalmia.
ead of a collection of pus, some part of the cornea may be found
ed by a dead white slough, or a large ulcerated and sloughing
e.
iris may also be inflamed and suppurating.

ATMENT.—The treatment of corneitis should be both local and Treatment.
utional.

al treatment.—All foreign bodies or other sources of irritation Local.
be removed; the eyes must be protected from light by a large
protectors, or, better still, by a bandage. Sedative applications
be employed, none being better than belladonna lotion, con- Belladonna
from 6 to 10 gr. of extract of belladonna to one ounce of water; lotion.
referred, a weak solution of atropine, gr. ½ to a pint of water,
used instead; the eyes should be bathed three or four times a
h either of these, and kept bound up with lint wetted with one
her.
s exist, a stronger solution of atropine, gr. ½ to gr. ij or iv
nce of water, should be dropped into the eyes as often as may
cessary.
eitis with suppuration warm applications will be found most
; the eye should be well bathed with warm belladonna lotion
n of poppies several times a day, and bound up firmly with
l in one or the other. If pain be a prominent symptom it
atly relieved by taking blood from the temples. Should a
of the cornea become infiltrated with pus, a free incision Incision.
ade by transfixing with a cataract knife, and cutting out
rough the centre of the infiltrated portion.
f corneitis, especially of the pustular form, where there
intolerance of light, and the disease constantly relapses or
e of other treatment, a seton should be placed in the skin Seton.
on one or both sides (*see* p. 398). In some cases the spas-
ction of the orbicularis may be kept up by the irritation
es at the outer canthus; in such a free division of the
lids and orbicularis by cutting through the canthus will
peedy cure.
n of chloroform is also said to act beneficially in some

Iridectomy. If in a case of suppuration or sloughing perforation of the cornea appear imminent, iridectomy should be performed (*see* p. 418).

Constitutional. *Constitutional treatment.*—Simple corneitis requires no constitutional treatment. In the interstitial form antisyphilitic remedies should be employed; to older patients the bichloride of mercury in doses of one sixteenth to one twelfth of a grain, combined with bark or other tonic, should be given twice or three times a day; to young children hyd. cum cret. gr. j to v three times a day.

The other forms of corneitis, especially the pustular, are best treated by the administration of tonics, as steel wine, dialised iron, tincture of perchloride of iron, quinine, &c.; and in strumous children cod-liver oil should also be prescribed, with good living and plenty of fresh air.

Ulcers of the cornea. **Ulcers of the cornea** present a great variety of forms. They may be transparent or opaque; they may be healing, indolent, vascular, or sloughing. The depth to which the corneal tissue is destroyed varies from slight abrasion of its surface to destruction of its whole thickness, causing perforation. The area of the cornea which is destroyed also varies from a small point to its whole surface.

Ulcers are sometimes described as marginal or central, according to their position. Ulceration of the cornea is constantly met with in cases of debility, from whatever cause arising. It is very common in patients recovering from acute diseases, as measles, scarlatina, and more especially smallpox, from impaired nutrition, not from formation of pustules or eruption on the cornea. Children are much more frequently affected than adults.

The symptoms of ulceration are very similar to those of corneitis. On examination any kind of ulceration may be found (one variety has been mentioned under Pustular corneitis). There may be one or more small *transparent ulcers*, which can only be seen in certain lights, and are very likely to be overlooked. They appear like small abrasions of the epithelium; sometimes the greater part of the surface of the cornea is found to be affected either by several small transparent ulcers or one large one. This form of ulceration is most commonly met with in adults of irritable, nervous temperament, and should always be carefully looked for when a patient of this description presents himself suffering from severe intolerance of light, watering of the eye, and smarting pain, without any very apparent cause.

Transparent ulcer.

Opaque ulcer. *Opaque ulcers* are visible enough; they may be of any size or number. At times they appear to be healing, in which case the edges appear smooth and the surface of the ulcer rough and opaque or cloudy. At others they are indolent, and again they may be spreading, when their edges are found to be clean cut, as if a piece of the cornea had been punched out by some sharp instrument; the surface of the ulcer appears glassy, and is often deeply excavated.

Sloughing ulcer. *Sloughing ulcer* is more or less opaque, spreads rapidly, both in area and depth, and if the process be not soon arrested the cornea will be perforated, and a prolapse of the iris of greater or less extent (according to the size of the perforation) will take place. If the opening be large the lens or some of the vitreous may escape.

Anterior synechia. In the greater number of cases of perforation of the cornea the iris pushes forward, fills the opening, and becomes adherent to its margin, forming an "anterior synechia," but a considerable prolapse may take

forming a projection or bulge from the surface of the cornea— Staphyloma.
ıyloma."

ginal or crescentic ulcer (ulcus corniæ serpens) is a somewhat Crescentic ulcer.
ır form of corneal ulceration; it is met with in persons of middle very intractable, and very liable to recur or relapse. This form eration is accompanied by very severe pain, great intolerance ıt, and very profuse lachrymation. On examination a crescentic of ulceration is found skirting generally the upper margin of the ; the ulcer is deep, its margin clean cut, and its surface glassy g.

ulceration spreads rapidly up to a certain point—remains sta- y for a time, and then commences to heal slowly, the healing s being frequently interrupted by relapses.

ulcerative process may involve both the upper and lower seg- of the cornea, but never passes up to its centre.

ıATMENT.—The treatment of ulcers of the cornea is very similar Treatment.
t of corneitis. In many cases, however, more especially those of ıal ulcer, the instillation of solutions of sulphate of eserine to iv to ℥j of water), three times a day or oftener, will be found beneficial. In all severe cases the eye should be kept carefully ged. Iridectomy should be performed in any case should perfora- e imminent (*see* p. 418).

cities of the cornea are the result of inflammation, ulceration, or Opacities of cornea.

y are met with of all densities and sizes; thin cloudy opacities ıown as "nebulæ," dense white ones as "leucomata." A dense Nebulæ.
opacity, involving the whole cornea, is called a "total leu-" an opacity of the same description occupying a part only, a ial leucoma." Should a corneal opacity have been caused by a Leucoma.
ating ulcer or wound of the cornea, an "anterior synechia" will bly be found associated with it.

se pterigium.—*Fleshy opacities* are sometimes met with near the False pterigium.
in of the cornea, and continuous with the conjunctiva. They omposed of granulation tissue, and are frequently the result of

EATMENT.—Corneal opacities have always a tendency to disappear, Treatment.
ially in children. Their removal may be aided by the use of ly irritating applications, which set up a certain amount of in- ed vascularity, and thus aid absorption. The remedies generally yed are drops of sulphate of copper, iodide of potassium, or ı; turpentine, pure, or mixed in various proportions with olive alomel powder, or the yellow oxide of mercury ointment. Any of may be used for some considerable time. Should no improvement taken place at the end of two or three months, and the opacity be tuated as to interfere with vision, an artificial pupil must be , and if the opacity be disfiguring it should be tinted (*see* p. 415). leshy opacities may be removed by operation, but are very liable to ear in their former site.

uries.—**Abrasions of the cornea** may be caused by scratches from s, ends of straw, finger nails, &c. They give rise to severe pain, intolerance of light, and watering of the eye.

EATMENT.—The eye should be kept carefully bandaged with lint d in belladonna lotion till the abrasion has healed. Abrasions.

Penetrating wounds.

Penetrating wounds of the cornea generally involve the iris or lens; in the former case an adhesion of the iris to the cornea (anterior synechia) is likely to be formed, or iritis set up; in the latter the lens will probably become opaque, a traumatic cataract being developed.

Very extensive wounds of the cornea may allow the escape of the lens or vitreous.

Treatment.

TREATMENT.—The eye should be kept carefully bound up with lint soaked in belladonna lotion, and in cases where the lens has been wounded, or iritis set up, a solution of atropine, one grain to one ounce of water, should be dropped into the eye from four to six or eight times daily.

Should the lens swell and cause pain and increase of tension, it must be removed without delay, or iridectomy must be performed.

Iridectomy may have to be performed at some future time for optical reasons, or to obviate the irritation caused by dragging on an anterior synechia. Traumatic cataract may also require to be treated.

Burns.

Burns of the cornea by lime, hot metals, &c., usually occur in conjunction with like injuries of the conjunctiva; they usually leave behind them opacities of greater or less extent and density, according to the severity of the injury, or may cause sloughing and destruction of the whole or greater part of the cornea.

TREATMENT, the same as that of burns of the conjunctiva.

THE SCLEROTIC AND EPISCLERAL TISSUE.

Episcleritis.

Inflammation of the sclerotic or episcleral tissue, or more commonly of both together, is a somewhat rare disease; it is characterised by the presence of purple swollen patches, covered by enlarged conjunctival vessels, and situated usually about the insertion of the recti muscles.

The purple patches often disappear from one portion of the globe, and appear again at another; the inflammation is chronic in its course, but subsides after a time, leaving some discoloration of the affected part; it is very liable to recur.

It occasionally follows operations for strabismus.

Treatment.

TREATMENT.—Sedative applications, as decoction of poppy-heads, or belladonna fomentation, should be used three or four times a day, and if there be much conjunctival vascularity or any mucous discharge, some astringent lotion, as chloride of zinc drops (*see* Formulæ, p. 360), should also be employed.

Any constitutional treatment that may appear called for should be adopted. In some cases tonics do most good; others, again, may be greatly benefited by a course of mercury or iodide of potassium.

This disease is usually described as "episcleritis."

Staphyloma of sclerotic.

Staphyloma.—A bulge of the sclerotic may occur from softening of its structure by inflammatory changes, which usually commence in the choroid.

Staphyloma may be met with in the ciliary region (ciliary staphyloma), about the equator (equatorial staphyloma), or near the optic nerve (posterior staphyloma). Little can be done in the way of treatment.

Gumma of sclerotic.

Gummata are occasionally seen upon the sclerotic; they occur as vascular, well-defined bosses, either singly or in groups of two or three.

Their diagnosis is not easy; they are likely to be confounded with sarcoma or patches of episcleritis. From the former they can be distinguished by their course, which is, though slowly, towards recovery, from the latter by being more abruptly defined and raised above the surface of the globe.

They are generally associated with syphilitic history, and often with other manifestations of syphilis. They require vigorous antisyphilitic treatment.

Injuries.—The sclerotic may be wounded by sharp instruments, or ruptured by blows; in the latter case the lesion usually takes place in the ciliary region, near the upper margin of the cornea. Wounds.

The sclerotic (as also the cornea) may be pierced by a shot or chip of metal, which may be lodged within the globe or have passed clean through it.

TREATMENT.—The treatment of injuries of the sclerotic depends much upon the extent and nature of the damage done. Treatment.

Small incised wounds will usually heal readily enough if the eye be kept carefully bandaged. Larger wounds may require to be closed by a suture.

Blows often cause complete disorganization of the globe, the aqueous and vitreous chambers being filled with blood, and hæmorrhage having taken place between the sclerotic and choroid, although no rupture of the external tunic has occurred.

Such cases must be carefully watched, and the eye kept bandaged with lint soaked in belladonna lotion.

In cases of extensive incised wounds, large ruptures, or wounds associated with lodgment of a foreign body within the globe, extirpation of the eyeball will probably have to be performed (*see* p. 431).

THE CRYSTALLINE LENS.

Congenital anomalies.—Variations in shape, absence of the whole (Aphakia) or part of the lens, and displacements, are met with as congenital defects. Congenital anomalies of lens.

Presbyopia (old sight).—Presbyopia depends on senile change of the crystalline lens, by which it is rendered harder than in youth and its elasticity is impaired. As a consequence its curvature can only be altered to a limited extent by the action of the ciliary muscle, and the power or range of accommodation is correspondingly diminished. Presbyopia.

Persons generally begin to experience the effects of presbyopia about the age of forty-five. The nearest point of distinct vision, which year by year has been receding from the eyes, now becomes inconveniently far off, so that small print can only be read with difficulty or not at all; distant vision, however, still remains acute. Age when it commences.

It has been arbitrarily decided that a person shall be considered presbyopic as soon as his nearest point of distinct vision comes to stand at twenty-two centimètres or further from the eyes, and the degree of presbyopia is expressed by the number of dioptrics (D) which it is necessary to give the eye in order to bring its near point up to this distance; or, in other words, to give it an accommodative power equal to 4·5 D, which is the power of the lens which the crystalline must add to itself in order to see distinctly at twenty-two centimètres. Thus, a person aged forty-five can only see distinctly at twenty-eight Its degree.

centimètres, that is, he can only add to his crystalline a lens equal to 3·5 D. In order to enable him to see distinctly at twenty-two centimètres we must give a lens which makes up the difference between 3·5 D and 4·5 D, *i.e.* 1 D. A person of forty-five, therefore, requires a convex lens of 1 D to remedy his presbyopia; the number of this lens also expresses the degree of presbyopia.

It has been determined by observation that presbyopia increases by one dioptric for every period of 5 years from 40 to 60; sometimes by one dioptric and sometimes by a half only, for each similar period from 60 to 80.

Lens required.

The following table shows the lens required at each period of five years by the emmetropic eye. Should hypermetropia exist its degree must be ascertained and added to the number given in the table. The degree of myopia, on the contrary, must be subtracted:

Age.	Dioptrics.	Age.	Dioptrics.
40	0	65	4·5
45	1	70	5·5
50	2	75	6
55	3	80	7
60	4		

Should our patient require to see at some particular distance, the numbers in the table need not be adhered to; he may be allowed to select those lenses which he thinks suit best. As a matter of fact we often find that the glasses given in the table are too strong, especially in hypermetropic persons who have become presbyopic before taking to glasses. Such persons have long been accustomed to strain their accommodation to the utmost, and will not thank us for giving them glasses which neutralize the whole of their hypermetropia as well as their presbyopia. We shall give much greater satisfaction by ordering glasses which a little more than neutralize the hypermetropia, and so give a little help without being an absolute correction.

Traumatic cataract.

Injuries.—Opacity of the lens (traumatic cataract) may be caused either by penetrating wounds of the cornea or simply by concussion.

Dislocation of lens.

Dislocation of the lens.—As the result of blows upon the eyeball, the lens may become partially or entirely displaced; it may still retain its transparency, but often becomes more or less opaque.

Direction of displacement of lens.

Displacement of the lens may take place upwards or downwards, laterally, forwards into the anterior chamber, backwards into the vitreous, or it may be entirely extruded from the globe through a wound in the sclerotic, and lie beneath the conjunctiva. In the three first positions the displacement is only partial and the margin of the lens can be seen by oblique illumination occupying some part of the pupil.

In displacement forwards the pupil will be found dilated, irregular in shape, and fixed; oblique illumination will show the lens lying partially or entirely in the anterior chamber.

In displacement backwards the iris will be tremulous, the pupil sluggish, and the anterior chamber deepened. Direct ophthalmoscopic examination will probably detect the lens lying in the ciliary region at the lower part of the eye.

In displacement beneath the conjunctiva the lens is found forming

a small rounded tumour, somewhere near the corneal margin, most frequently at its upper part.

Treatment. TREATMENT.—If the lens be displaced partially or into the anterior chamber, and still retain its transparency, it may be left alone. But should it become opaque or appear to be setting up irritation, it should be removed by extraction, preferably associated with iridectomy. A transparent lens may remain for years in the anterior chamber, and, with the exception of impairment of vision, give rise to no inconvenience. If its capsule has been lacerated, however, it will become opaque, and if not extracted will gradually be removed by absorption.

A lens displaced into the vitreous chamber will very probably act as a foreign body, and set up glaucomatous changes, in which case it should be removed at all risks; but if it produces no irritation is best left alone.

A lens displaced beneath the conjunctiva may also be left to itself.

Cataract will be considered in the section on operations.

THE IRIS AND CHOROID.

Coloboma. **Congenital anomalies.**—**Coloboma** signifies a cleft condition of the iris or choroid, dependent on failure of closure of the fœtal fissure. In the iris it occurs as a deficiency of the lower segment, appearing as if iridectomy had been performed downwards. In the choroid it is seen (on examination with the ophthalmoscope) as a brilliant white figure, commencing at the optic disc, and continuing downwards and forwards for a variable distance towards the ciliary processes, through which, in extreme cases, the cleft may extend, and be even continuous with a similar deficiency of the iris.

The albino. In the **Albino** the pigment of the iris and choroid is absent to a greater or less extent, and with the ophthalmoscope the fundus of the eye appears of a yellowish-white colour.

Irideremia. **Irideremia, or congenital absence of the iris,** is occasionally observed.

Persistence of pupillary membrane. **Persistency of the pupillary membrane.**—Small portions of the membrane which at a period of fœtal life covered the pupil occasionally remain, and may be seen as one or more fine threads, somewhat resembling cobwebs, passing across the pupillary area, and attached at either end to the anterior surface of the iris, near the margin of the pupil.

Anomalies of colour. **Anomalies of colour.**—The iris of one eye may be brown, that of its fellow being blue, or differences in colour may occur in different parts of the same iris.

Tremulous iris. **Tremulous iris (iridodonesis)** signifies a tremulous condition of the iris, which shakes about as the eye is moved. This condition is met with when the iris has lost the support of the crystalline lens, when the vitreous humour is abnormally fluid, or the iris totally paralysed.

Paralysis of iris. The term *paralysis* should, strictly speaking, be applied only to cases where the iris is tremulous, all its proper movements being destroyed and the pupil of moderate size; but it is often used in the condition of dilatation of the pupil met with in some cases of paralysis of the third nerve; in which, however, only the circular fibres are affected.

Mydriasis. Myosis. **Mydriasis** signifies abnormal dilatation of the pupil; **Myosis,** abnormal contraction.

Cases are occasionally met with in which the ciliary muscle, circular

and radial fibres of the iris are all paralysed, the pupil is of medium size and does not act. The disease has been called "ophthalmoplegia interna" by Mr. Hutchinson.

Tumours of iris.

Tumours seldom originate in the iris itself, but its structure often becomes implicated by growths commencing in deeper parts of the globe (*see* Tumours of Eyeball); instances, however, of malignant growths, dermoid and simple cysts, and of the cysticercus, have been met with in the iris.

Inflammation of the Iris (Iritis).

Causes.

Causes.

Local.—Irritation from foreign bodies in the conjunctival sac or cornea; friction of the cornea by granular lids or inverted lashes; injuries to the iris itself by operations, or accidents, with or without the lodgment of foreign bodies in its substance or on its surface; pressure by a swollen crystalline lens, and exposure from perforation of the cornea.

Constitutional.—Debility, after acute disease, over-lactation, &c.; certain specific diseases, as syphilis, rheumatism, and gout.

Symptoms.

Symptoms.—The following symptoms are met with in most cases of iritis; changes of colour, cloudiness and loss of polish of the iris, sluggishness or complete immobility and (as a rule) contraction of the pupil, injection of the ciliary region (ciliary redness), watering of the eye, and impairment of vision. Other symptoms met with occasionally are pain, intolerance of light, irregularity in outline of the pupil, inflammatory products—pus or lymph nodules—visible to the naked eye.

Varieties of iritis.

Three **varieties** of iritis are commonly met with. 1. Simple iritis. 2. Recurrent or rheumatic iritis. 3. Syphilitic iritis.

Simple iritis.

Simple iritis.—All the more constant symptoms of iritis are present, often accompanied by more or less severe pain. An uncomplicated attack lasts from one to two weeks or longer, and usually ends in resolution, the iris quite recovering its normal condition, but a few adhesions may form between the iris and lens-capsule (posterior synechiæ). In this as well as in the other forms of iritis, however, the inflammation may run on to the formation of a considerable quantity of new material or into suppuration.

Recurrent iritis.

Recurrent or rheumatic iritis occurs in persons who are subject to attacks of rheumatism or gout, and also in the children of rheumatic or gouty parents; an attack of this form of inflammation presents all the more constant symptoms of iritis, and has one character peculiar to itself, viz. its tendency to recur, some patients having had as many as twenty or more separate attacks; in some cases the attacks observe a remarkable periodicity, recurring regularly at the same time of year. The inflammation sometimes appears in one eye, sometimes in the other, or perhaps in both, rarely, however, simultaneously, but at short intervals, the second eye becoming affected long before the first has begun to recover. Recurrent iritis is frequently accompanied by more or less haziness of the cornea and aqueous humour. In some cases very severe pain of a dull aching character is experienced in the eyeball, forehead, side of nose, and temple; in others the attack is most insidious, the patient's attention not being attracted until a considerable amount of new material has been thrown out, extensive adhesions

Haziness of cornea.

formed, the sight of one eye much impaired and the inflammatory action extended to the other. The great feature of this form of iritis is its tendency to recur. The cause of the recurrencies is not very evident; they are probably due primarily to "posterior synechiæ," and are prevented by the performance of iridectomy.

All persons, however, who have "posterior synechiæ" are not subject to recurrent iritis; so that in all probability in those who are liable to repeated attacks there is a tendency to the lighting up of inflammation upon very slight provocation, such as the dragging of posterior synechiæ.

Syphilitic iritis.

Syphilitic iritis is, perhaps, the most common of all the forms. A typical case presents all the constant symptoms of iritis in a very marked degree, the zone of ciliary redness being extremely well defined. There may be, besides, certain peculiar nodular excrescences, of a dirty yellow colour (known as lymph-nodules), situated on the surface of the iris or at its pupillary margin, and at times extending into the pupil, which may be completely blocked by them. These excrescences are syphilitic gummata, and their existence renders the diagnosis of syphilitic iritis certain; they are, however, only occasionally present, and in the greater number of cases met with the Surgeon will have to take into consideration the patient's previous history, ascertain the existence of other signs of syphilis, and make his diagnosis accordingly.

Lymph-nodules.

Syphilitic iritis occurs most frequently between the ages of fifteen and forty, but is occasionally met with as a manifestation of congenital syphilis in infants, and often in cases of interstitial keratitis.

Results of iritis.

Results of iritis.—In many cases, especially if early and properly treated, perfect recovery takes place; in others permanent signs of inflammation are left. The morbid changes more commonly met with are—

Atrophy of iris, &c.

(1) The iris itself may be found *atrophied, rigid*, or *rotten*, and very prone to bleed freely on the slightest wound. These conditions become most apparent when operating upon its structure. On attempting to perform iridectomy considerable difficulty will be experienced in removing a portion of the iris, which may be so tough that none of it can be torn away, or so rotten that only the portion included between the branches of the forceps is removed, or hæmorrhage may take place to such an extent as to prevent the completion of the operation.

Posterior synechia.

(2) *Adhesions to neighbouring parts* ("*synechiæ*") may have formed, those most commonly met with being between the iris and lens-capsule ("posterior synechiæ").

Posterior synechiæ are generally situated at the pupillary margin, and vary in extent from a few adherent tags, of this part only, to complete adhesion of the whole posterior surface of the iris to the lens-capsule, this latter condition being known as "total posterior synechia."

Total posterior synechia.

Anterior synechia.

Adhesion of the iris to the cornea "anterior synechia" (should this occur at all as the result of iritis) will be found about its greater circumference.

Closed pupil.

(3) *Closure of the pupil* by inflammatory material; *opacities upon the lens-capsule* caused by adhesion of the "uvea" detached from the posterior surface of the iris.

Capsular cataract.

(4) Dense inflammatory deposits in or beneath the capsule, or involving the superficial fibres of the lens itself (*capsular cataract*), may also be met with.

Treatment.

TREATMENT.—In treating iritis we must take care, *first*, to remove any local cause, such as a foreign body, opaque swollen lens, &c., and to cure granular lids, or remove inverted lashes. *Secondly*, we must endeavour to dilate the pupil. *Thirdly*, to relieve pain. *Fourthly*, any constitutional treatment that may appear called for should be employed. (The means of carrying out the first indication are detailed elsewhere.)

Local.

In order to dilate the pupil a few drops of a strong solution (gr. iv to ℥j) of sulphate of atropine should be placed between the eyelids by the surgeon himself at each visit, and a weaker solution (gr. ¼ to gr. 1 to ℥j) should be used by the patient from four to eight or twelve times a day. If the case is treated at the commencement, more or less dilatation of the pupil will usually take place; but should the iris have become infiltrated with inflammatory matter, and adhesions formed, little or no effect will be produced; the atropine should, however, be persevered with.

Atropism.

Some patients are extremely intolerant of atropine; in such it produces swelling and inflammation of the eyelids and face of an erysipelatous nature, known as "atropism."

If atropism occur a substitute must be found for the atropine. Daturine, hyoscyamine, duboisine, hematropin, or other mydriatics, may be tried, or the atropine may be used in the form of an ointment, gr. i of sulphate of atropine to ℥j of vaseline. In one case I found, after all else had failed, that mixing gr. 1 of carbolic acid in ℥j of atropine solution prevented atropism.

Iritis with suppuration.

In cases of iritis with suppuration the eye should be fomented frequently with hot belladonna lotion, and kept bound up with lint soaked in the lotion.

In cases accompanied by much pain blood should be taken from the temples by leeches or the artificial leech. Atropine may give rise to pain by causing dragging upon adhesions, and should be used with caution in cases where its application is attended by much suffering, especially if it have no effect upon the pupil. The eyes should be protected from light by a green shade or protectors until the inflammation has subsided.

Constitutional.

Of *constitutional remedies* there is none so useful in the treatment of iritis *as mercury*. The drug should be given in some form or other, so as speedily to affect the system in all cases where inflammatory products are plentifully produced, whether the inflammation be of syphilitic origin or not. A pill containing gr. ij of Pil. Hydrarg. and gr. ¼ of Pulv. Opii may be taken three times a day, and is a very convenient and effectual mode of administration. Mercurial inunction or vapour baths, may be employed if preferred.

Mercury.

Tonics.

If the iritis occur in debilitated states of the system, or the inflammation go on to suppuration, tonics, as iron or quinine, should be prescribed, and a plentiful supply of good food given. Should there be much pain opium must be given, and it is well to prescribe the drug in conjunction with extract of belladonna or hyoscyamus. In rheumatic iritis salicylate of soda, in doses of gr. xv to gr. xxx three times a day, often does much good.

The results of iritis, should they seriously interfere with vision, require the performance of iridectomy or some one of the operations for artificial pupil. Iridectomy should also be performed in cases of recurrent iritis. The removal of a portion of iris in some manner—probably by preventing dragging on adhesions—has a marvellous effect in preventing recurrences.

Injuries.—The iris may be cut, torn, or bruised; prolapsed through, or adherent to, the cornea, in cases of penetrating wounds of that structure (*see* Wounds of the Cornea); or it may be separated from its insertion to a greater or less extent by concussion, without external wound. Any of these injuries are liable to set up iritis, which may possibly be followed by suppuration. Injuries.

TREATMENT.—The injured eye should be kept carefully bandaged with lint soaked in belladonna lotion, and if much pain is complained of, or inflammatory symptoms arise, blood should be freely taken from the corresponding temple, either by leeches or the artificial leech. Treatment.

As in iritis from other causes, the pupil may become blocked, or extensive synechiæ form, requiring operative interference at some later period (*see* Operations on Iris).

Hyperæmia of Choroid.

Increased vascularity of the choroid is not unfrequently met with, more especially in myopic persons; it should be suspected if a feeling of fulness and tension of the eyes, accompanied by watering and intolerance of light, is complained of. Hyperæmia of choroid.

On examination with the ophthalmoscope increased redness of the choroid (especially of that portion nearest the outer side of the optic disc) and some enlargement of the choroidal vessels can be made out; these changes will, however, very probably be overlooked by an inexperienced observer.

TREATMENT.—The eyes should be kept carefully at rest, protected from light, cold douches employed, and all positions (as stooping or hanging the head) which cause congestion of the eyeballs carefully avoided; blood may be taken from the temples, and if glasses have been worn their use must be discontinued. When the more acute symptoms have passed off any anomaly of refraction must be carefully neutralised by suitable lenses. Treatment.

Inflammation of the choroid, "Choroiditis," occurs under much the same conditions as iritis; it also plays a prominent part in sympathetic ophthalmia, and is not unfrequently associated with inflammation of the iris—"choroido-iritis." Two forms will be commonly met with—simple and syphilitic. Choroiditis.

Symptoms.—In all cases of choroiditis more or less loss of transparency will be found. Pain, intolerance of light, impairment of vision, fulness of the veins emerging from the sclerotic in the ciliary region, ciliary redness, dilatation and sluggishness of the pupil, and increased tension of the globe, are symptoms often met with in choroiditis, but are by no means characteristic of it. A diagnosis can only be made with certainty by examination with the ophthalmoscope. Choroido-iritis.

The changes seen in the choroid with the ophthalmoscope are, greyish or yellowish patches or spots of exudation surrounded by more or less redness (hyperæmia), and at a later period patches of atrophy. The exudation may occur in one or more large patches, or be dis-

tributed over the whole or greater part of the choroid in the form of spots, this latter condition being known as "choroiditis disseminata."

Choroiditis disseminata.

We know that the morbid changes noticed are in the choroid, from their relation to the retinal vessels which pass in front of and are not obscured by the opacity.

Syphilitic choroiditis.

Syphilitic choroiditis (in typical cases) is characterised by the presence in the choroid of yellowish lymph-nodules, similar to those seen in syphilitic iritis; but, as in the latter disease, typical cases are only occasionally met with, and we must be guided by the same rules in forming a diagnosis. Choroiditis disseminata is syphilitic; the atrophic changes left by it are seen in spots of white and dark dotted about the fundus; often combined with an irregular band of dirty white, extending round the optic disc. These changes are frequently seen in the subjects of congenital syphilis; the choroidal disease is in many instances associated with floating opacities in the vitreous, and may be looked upon as a certain indication of syphilis.

Choroiditis is frequently associated with inflammation and opacity of the vitreous humour; the retina covering the affected portion of choroid is usually involved in the inflammatory change, and the optic disc may be implicated if choroiditis exist in its vicinity.

Atrophy of choroid.

Atrophy of the choroid, as above stated, frequently follows inflammation. The ophthalmoscope shows white or dirty white patches, or spots corresponding to the areas previously occupied by inflammatory exudation, caused by destruction of the choroid, allowing the white sclerotic to show more or less plainly through it. The atrophic patches are frequently surrounded by dark borders, from accumulation of pigment which has been displaced by the inflammatory material.

Cyclitis.

Inflammation of the ciliary portion of the choroid (ciliary body) is known as "cyclitis."

Cyclitis is characterised by redness and swelling of some part or the whole of the ciliary region, with considerable enlargement of the veins of the retina, choroid, and iris, and pain in the eyeball, aggravated by pressure in the ciliary region. Cyclitis may be caused by injury or may depend upon syphilis, inherited or acquired. Softening and shrinking of the globe is very likely to follow from impairment of nutrition, dependent on interference with the circulation of blood. Suppuration may also take place. Wounds implicating the ciliary region of the sclerotic should always be looked upon as much more serious than those of other portions of the tunic, as cyclitis is frequently set up by such injuries. Cyclitis is not uncommonly associated with iritis—"irido-cyclitis."

Irido-cyclitis.

Treatment.

TREATMENT.—The treatment of choroiditis should be very similar to that of iritis. Iridectomy does good in some chronic cases or in those in which there is increase of tension of the globe. For the atrophic changes no treatment is of much avail.

Deposit of bone.

Bone upon the choroid.—Deposits of bone are not unfrequently met with upon the inner surface of the choroid in eyes that have been blind and shrunken for years.

Tubercle.

Tubercles in the choroid.—In cases of general tuberculosis deposits of tubercle have occasionally been met with in the choroid.

Injuries of choroid.

Injuries.—The choroid may be injured by foreign bodies entering the eyeball or ruptured by violence, without perforation of the tunics.

In the former case (more especially if a foreign body be lodged in

structure of the choroid) inflammation is very liable to follow, the eyeball being eventually lost by suppuration or shrinking. A rupture of the choroid from external violence is attended with more or less hemorrhage, which fills the rent made in its structure with blood, and may cause considerable displacement of the retina.

Appearance of rupture.

Seen with the ophthalmoscope soon after the receipt of the injury, a rupture of the choroid appears as a more or less elongated blood-clot; later the blood becomes absorbed and a white linear figure is left, from the white sclerotic showing through the rent in the choroid. This form of injury is not often followed by destructive inflammation.

Treatment.

TREATMENT.—Injuries of the choroid should be treated in the same manner as injuries of the sclerotic, cornea, or iris, with belladonna lotion, lint, and a bandage.

Sympathetic ophthalmia.

Sympathetic Ophthalmia.

Sympathetic ophthalmia is the name applied to a peculiar form of inflammation of the choroid, ciliary body, and iris, coming on in one eye in consequence of morbid changes which have previously existed or are still in operation in the other.

Danger of wounds of ciliary region.

The most common causes of sympathetic ophthalmia are injuries of one eye, *especially wounds implicating the ciliary region*, or associated with *lodgment* of a foreign body in the interior of the globe.

Character of inflammation.

The wounded eye shortly after the receipt of an injury may become affected by keratitis punctata and choroido-iritis of a *markedly adhesive character*; pain more or less severe will be complained of, sight rapidly lost, extensive synechiæ form, the tension of the globe, at first somewhat above par, diminish, and shrinking of the eyeball follow.

Treatment.

At any time during the foregoing changes in the injured eye the sound one may become irritable and painful, and a similar inflammation may be set up in it, leading rapidly to a like result.

TREATMENT.—Where sympathetic ophthalmia has been once established, in all probability irreparable damage will be done; the great point to bear in mind is to prevent its occurrence by *timely extirpation of the damaged globe* (*see* Extirpation of the eyeball). Should the disease have become fairly established, little benefit can be expected to result from such extirpation, as the morbid changes will probably continue in the sympathetically inflamed globe, in spite of the removal of that primarily affected. The sympathetically affected eyeball (or if excision have not been performed both eyes) should be kept carefully bandaged with lint soaked in belladonna lotion; all light should be carefully excluded by using a black bandage and keeping the patient in a darkened room. Pain must be relieved by the same methods as in cases of iritis. Any constitutional treatment that may appear necessary should be employed, and as soon as the acute inflammatory symptoms have entirely subsided iridectomy should be performed. This operation often exerts a very beneficial influence upon the nutrition of the globe (*see* Iridectomy), and should be repeated a second or even third time should the new pupil become (as is very likely to be the case) occluded by inflammatory exudations.

Should suppurative inflammation be set up in one eye, sympathetic changes need not be feared in the other; it is only in the adhesive form of *choroido-iritis that sympathetic* ophthalmia is likely to occur.

Sympathetic Irritation.

Sympathetic irritation.

It not unfrequently happens that soon after the receipt of an injury to one eye its fellow becomes slightly painful, intolerant of light and irritable. These conditions may remain unchanged week after week and eventually subside. They make up what is known as sympathetic irritation.

When sympathetic irritation occurs we must always watch the injured eye carefully, and if signs of choroido-iritis or keratitis punctata appear in it, it should be immediately excised. If no such symptoms occur, however, its removal is not necessary.

THE VITREOUS HUMOUR.

Opacity of vitreous.

Opacities in the vitreous are frequently met with in cases of myopia, and often as the results of choroiditis.

Inflammation.

Inflammation of the vitreous occurs occasionally; it is generally of syphilitic origin or caused by injuries, especially the lodgment of foreign bodies within the globe. Vision becomes misty, and on examination the humour is found to be more or less turbid.

TREATMENT.—Should the inflammation be of syphilitic origin, anti-syphilitic remedies should be employed; should it depend on injury, the eye must be kept bandaged with lint soaked in belladonna lotion, and measures taken to subdue the inflammation.

Hæmorrhage.

Hæmorrhage into the vitreous.—Occasionally bleeding takes place into the vitreous humour to a considerable extent. Impairment of vision is complained of, usually coming on suddenly, and often during some exertion. Examination with the ophthalmoscope (direct method) shows the vitreous chamber to be occupied by a turbid irregular cloud which floats about as the eyeball is moved, gradually subsides to its lower part when the movements are discontinued, and is stirred up again on the movements of the globe being repeated. The blood becomes absorbed to a greater or less extent in the course of time, but very commonly some permanent opacity is left.

GLAUCOMA.

Definition.

By **glaucoma** we understand "A series of morbid changes of the eyeball; the most prominent of which, and apparently the one which causes all the others, being an increase of tension of the globe" (Bader).

Varieties.

The cause of the increase of tension is unknown, but is supposed to result from undue accumulation of the intra-ocular fluids, dependent on hyper-secretion or deficient removal. Glaucoma is said to be *simple* when the increase of tension progresses slowly and continuously without inflammatory outbreaks; *acute or chronic* when attended by attacks of inflammation.

Simple glaucoma.

Simple glaucoma presents no very marked symptoms, its course being most insidious. It is characterised by gradual decrease of acuteness of vision, with narrowing of the visual field, impairment of the power of accommodation, causing rather rapid increase of presbyopia, sluggishness in the movements of the iris, some dilatation of the pupil, and some apparent haziness of the lens. Increase of tension is probably one of the earliest symptoms, but is very liable to be overlooked until

Increase of tension.

isease is far advanced and considerable hardness of the globe aken place. With the ophthalmoscope spontaneous pulsation of etinal arteries may be seen, or pulsation may be produced by light pressure upon the globe. The vessels, especially the veins, hinner on the surface of the optic disc than in the surrounding , and the disc itself may be more or less cupped. The cup of oma is characterised by a bluish appearance of the greater portion e disc; upon this blue portion the vessels appear very small and inct, or they may be quite invisible; the margin of the disc is , and the large tortuous retinal vessels are seen curling up over ge, and appearing on the surface of the retina at a point not nous with their course upon the nerve surface. Small hæmor- s may also be met with upon the retina. Spo puls

Cuppi disc.

ner or later, in any form of glaucoma, if relief be not given, ondition known as *absolute glaucoma* is established. The eyeball es stony hard, the pupil widely dilated and fixed, the cornea and anæsthetic, the iris and aqueous humour discoloured, the ior chamber shallow, and the lens more or less opaque. A few d veins are seen issuing from the globe in the ciliary region, the tic may be somewhat bulged in places and bluish in colour, and onjunctiva is extremely rotten, tearing on any attempt to seize h forceps. On examination with the ophthalmoscope all appears behind the pupil, or a dull red reflection may be returned from nterior, but no details of the fundus can be made out. All ption of light is lost. Absolute glaucoma.

some cases of acute glaucoma, and almost invariably in chronic oma, the onset of the disease is preceded by premonitory sym- Premonitory symptoms.

se are, as in simple glaucoma, rapidly increasing presbyopia and increase of tension of the globe, sluggishness and dilatation of pil, some apparent haziness of the lens, and narrowing of the ield.

es these we may find some congestion of the veins emerging e sclerotic in the ciliary region. There may be periodic attacks ss of vision, objects appearing as if veiled by a greyish or ist (London fog); in the later stages we may have a halo flame, or the appearance of a rainbow, and at times attacks and about the eyeball.

glaucoma usually commences suddenly with well-marked ory symptoms. The patient will state that he was seized y during the night) with sudden severe pain in the eye; the e described as affecting, not only the eyeball, but the whole responding side of the head, and he will have found that f the painful eye is much impaired or entirely lost. On the eyelids will be found slightly reddened and swollen, iva somewhat chemosed, and its vessels, as well as those e deeply in the subconjunctival tissue, enlarged. There se lachrymation, and often much intolerance of light; humour will very probably be somewhat turbid. The moderately dilated, somewhat irregular and fixed, and the globe greatly increased. Acute glaucoma.

tion with the ophthalmoscope some of the appearances ler simple glaucoma may be found, but the media will Ophthalmoscopic appearances.

probably be so hazy as to obscure the parts behind, a dull-red reflection being all that can be made out.

The acute symptoms may pass off in the course of a few days or weeks, leaving the eye more or less permanently damaged. Similar attacks may recur, but more frequently the disease relapses into a chronic state.

Chronic Glaucoma.

Chronic Glaucoma, the form most commonly met with, is characterised by the occurrence of slight inflammatory attacks, associated with temporary increase of dimness of vision and more or less pain in and around the eyeball. On examination the field of vision will be found to be limited, the tension of the globe increased, and if the patient present himself during an inflammatory attack, the conjunctiva and subconjunctival tissue will be found unduly vascular, the pupil somewhat dilated, and the movements of the iris sluggish.

Peculiar affection of vision.

The loss of vision, in cases of chronic glaucoma, is attended by symptoms like those of the premonitory stage. Patients complain that their sight is always somewhat misty, that there is an appearance of a bright halo around a candle or other flame, that they see colours resembling a rainbow, and often of great beauty, and occasionally flashes of light and fiery circles; the last mentioned symptoms are, however, common to all forms of retinal irritation. Vision is always worst during the inflammatory attacks and recovers to a certain extent during the remission, never, however, returning to the same condition as before the attack.

The ophthalmoscope shows changes similar to those mentioned under simple glaucoma.

Glaucoma fulminans.

There is yet another form of glaucoma requiring mention, fortunately rarely met with. Its principal characteristic is the extreme suddenness and violence of its onset; its symptoms resemble those of acute glaucoma in an aggravated form. This variety of glaucoma is known as *glaucoma fulminans*, and the eye attacked by it may be entirely lost in the course of a few hours. The attack is occasionally accompanied by severe headache and vomiting.

Glaucoma is essentially a disease of the latter half of life, occurring most frequently between the ages of forty and sixty, but occasionally in young adults, or even in children. Glaucoma almost always affects both eyes, not, however, simultaneously, but at more or less considerable intervals.

Diagnosis of glaucoma.

In order to diagnose glaucoma we must be well acquainted with the method of ascertaining the tension of the globe, and also with the use of the ophthalmoscope (*see* Examination of eyeball, &c.).

We must also remember that the injurious effects of pressure are evidenced earliest in the peripheral portions of the retina, and should therefore very carefully examine the condition of the *visual field* in all suspected cases (*see* Examination of field of vision).

Contraction of visual field.

Cases are frequently met with in which great contraction of the visual field has taken place, although central vision is still acute.

Rapid increase of presbyopia.

Another symptom which should lead us to suspect glaucoma is the *rapid increase of presbyopia*. Patients affected by the simple or chronic forms of the disease are constantly changing their glasses, as they find that those which at first appear to suit become useless in the course of a few months.

Apparent haziness of

Apparent haziness of the crystalline lens is a symptom requiring

special attention; otherwise the surgeon may fall into the fatal error of mistaking chronic or simple glaucoma for cataract, and allow the disease to continue until sight is irrevocably lost. In such cases ophthalmoscopic examination will most probably show that there is little or no real opacity of the lens, and this, aided by a careful examination of the tension of the globe and the state of the visual field, will prevent so disastrous a mistake.

Besides the foregoing we not unfrequently meet with what is known as "secondary glaucoma," *i.e.* glaucoma coming on in the course of some other disease, as corneitis, ulceration of cornea, iritis, &c. Glaucoma occurring in young persons is usually secondary. Glaucoma following injury is spoken of as "traumatic glaucoma." Secondary glaucoma.

Treatment.—Glaucoma can be remedied *by operation alone*. And it is our duty to explain to the patient the nature of his case and to urge upon him most strongly the *necessity* for operative interference. Treatment.

Patients suffering from glaucoma often evince the greatest unwillingness to undergo an operation; this unwillingness is explained by the fact that during the *remissions* of the disease little or no inconvenience is experienced, and, moreover, even at the time that an attack of inflammation is present the sufferer will be encouraged by the hope that the symptoms will pass off (as they in all probability have done in previous attacks), leaving the eye but little damaged. Nevertheless we must always bear in mind *that an operation, to be successful, must be performed early*, and must not be satisfied until we have convinced our patient of this. Most patients will readily submit to an operation when one eye has been lost and the disease has commenced in the other.

Several operations have been practised for the relief of glaucoma, but iridectomy and sclerotomy are those which give the best results. Iridectomy and sclerotomy, to be effectual, should be performed as early as possible; as a rule, no good is likely to result from an operation in cases where vision has been reduced to bare perception of light; but in acute glaucoma much improvement may take place even though all perception of light have been lost for some days. Iridectomy and sclerotomy.

In performing iridectomy for glaucoma we must take care to remove the iris well down to its insertion and to excise a good broad piece (*see* p. 420); merely cutting away a portion of the iris near the margin of the pupil does no good. The operation is easy enough of performance in cases of acute glaucoma, but in those of old standing, where the structures are rotten or the pupils so widely dilated that the iris has become a thin rim at the periphery of the anterior chamber, it is anything but simple. In such cases sclerotomy is to be preferred to iridectomy.

In cases of glaucoma where for any reason an operation does not seem advisable we must do our best to give relief by medical treatment. The means which will be found most useful are the instillation of solutions of sulphate of eserine (gr. ii to iv to water ʒj), application of sedative fomentations, administration of opium, and the local abstraction of blood by leeches or the artificial leech. Medical Treatment

Atropine *should not be used* in glaucoma, as it causes increased vascularity of the globe, and with it augmentation of tension. Its application is recommended in most works on ophthalmic subjects, but Atropine.

it does more harm than good. Eserine, however, has a contrary effect and is often of great benefit.

THE RETINA AND OPTIC NERVE.

Vision.

Vision.—Space will not allow of a detailed account of all the anomalies of vision which may be met with. Before the introduction of the ophthalmoscope all cases of *want of sight* occurring without cause apparent to the unaided eye were collected together into two classes bearing the names of "amblyopia and amaurosis."

Amblyopia and amaurosis.

To the former were referred all cases where vision was much impaired but not entirely lost, to the latter cases in which not even perception of light remained. But now that the ophthalmoscope has come so generally into use, making the interior of the globe as accessible to our sight as the exterior, we have come to refer "amblyopia and amaurosis" to their proper causes, and the terms have fallen into comparative disuse. For instance, if in a case of want of sight we find on ophthalmoscopic examination that there is haziness of the vitreous, inflammation of the retina, &c., we do not say (as formerly) that the patient is "amblyopic," but that he is suffering from opacity of the vitreous, retinitis, &c. Again, in cases of total blindness, the ophthalmoscope will in all probability detect atrophy of the optic nerve or other lesion, and instead of saying that the patient is "amaurotic" we say that he is suffering from atrophy of the optic nerve, &c. The terms "amblyopia and amaurosis" may, however, still be used in some rare cases where there is a partial or complete loss of sight, associated with an apparently healthy condition of all the ocular structures.

Hyperæmia of retina.

Hyperæmia of the retina occurs from overstrain of the eyes in doing near work (especially in hypermetropic or astigmatic persons), or from constantly looking at bright light; the disease is not uncommon amongst engine-drivers and others who work over a blazing fire.

The patient complains of some dimness of vision, and a feeling of fulness and discomfort in the eyes. On examination with the ophthalmoscope the retinal vessels, both arteries and veins, will be found increased in size, and a greater number of each will be visible than in the healthy retina.

Active and passive hyperæmia.

This form of hyperæmia may be described as "active;" another form of hyperæmia, affecting only the retinal veins, which become enlarged, tortuous, and sometimes varicose, may be described as "passive;" this condition is indicative of obstruction to the return of blood from the eyeball (*see* Ischæmia).

Hyperæmia of the retina, especially the active form, is not easily recognised, as the limits between health and disease fade almost imperceptibly into each other, and considerable experience is required in order to judge with certainty where one ends and the other begins.

Treatment.

TREATMENT.—Active hyperæmia should be treated by rest, carefully shielding the eyes from bright light by means of neutral tint protectors or a shade. After the subsidence of the hyperæmia any anomaly of refraction should be carefully neutralized.

Retinitis.

Passive hyperæmia is usually an indication of some more serious disease, and requires no special treatment.

Inflammation of the retina (retintis).—*Causes.*—Retinitis may

requently depends on some constitutional condition, as albuminuria r syphilis; it may also arise from embolism of the vessels of the etina, hæmorrhage into its substance, or from cerebral disease; from umours or entozoa within the globe, exposure to sudden flashes of right light, or wounds of the eyeball. It may also be secondary to horoiditis, iritis, or cyclitis.

Retinitis is characterised by hyperæmia of the retina, associated vith more or less dense and extensive opacity of its structure, and requently with extravasations of blood in its substance.

Affects vision.

Disturbance of vision may be a prominent symptom, or the patient nay hardly be aware that anything is amiss with his eyes. The legree of impairment of vision depends upon the situation and extent f the inflamed portion of the retina; for instance, a small patch of nflammatory exudation in the region of the yellow spot will cause nuch loss of sight, whereas a considerable amount of opacity situated eripherally will give rise to scarcely any symptoms.

Pain, photophobia, coloured vision, and flashes of light, are symptoms ccasionally met with in inflammation of the retina.

Acute retinitis is rarely met with, and if it should occur would hardly e recognised, as the inflammatory exudation would be transparent, nd, therefore, invisible; consequently, the only appearance revealed y the ophthalmoscope would be enlargement and tortuosity of the etinal vessels.

The forms of retinitis which give rise to striking ophthalmoscopic ppearances are essentially of a chronic nature, and are frequently ssociated with inflammatory changes in the choroid and optic nerve.

Retinitis may affect one or both eyes, those forms which are of nstitutional origin usually affecting both, though not always in the me degree. Several varieties of retinitis are described.

Simple retinitis.

Simple retinitis.—The ophthalmoscope shows a more or less general rbidity of the retina, varying from a scarcely perceptible cloudiness ving the idea that the structure is coloured and visible instead of irely transparent) to an uniform greyish-white or mottled opacity, ch appears to cover the choroid like a veil.

he outline of the optic disc is indistinct. The retinal veins appear rged, dark coloured, evidently gorged with blood, often twisted eir course, and they may be in parts hidden by the inflammatory ation. The condition of the arteries is nearly normal, or they may r too thin.

all hæmorrhages are frequently detected in the course of the ded veins.

Hæmorrhagic retinitis.

norrhagic retinitis.—The optic nerve will be found reddened, hat swollen, its outline obliterated, its transparency so much l that the course of the retinal vessels upon its surface and in stance cannot be traced; the retinal veins are turgid and s in their course, presenting alternately light and dark portions, g as they lie deeply in the engorged retina or more super- ear its inner surface. The retinal arteries, as in the simple retinitis, are nearly normal or too thin.

Peculiarity of blood extravasations.

incipal characteristic of the disease is the occurrence of exten- orrhage, most marked around the optic disc, and fading away into the surrounding parts. The blood-extravasations have striated appearance, and radiate, spoke-like, from the optic

disc as a centre. In some cases the retina immediately surrounding the disc is uniformly soaked with blood, the bright red colour thus produced gradually shading off externally into the spoke-like appearance above mentioned.

As time goes on the extravasated blood undergoes changes, becoming brown in colour, and eventually partially or entirely absorbed.

Retinitis pigmentosa.

Retinitis pigmentosa is a peculiar form of degeneration of the retina, met with most frequently in the offspring of blood relations; the sufferers are often deaf and dumb, and may be partially idotic.

Night blindness.

The most marked symptoms of the disease are *night blindness* and *gradual narrowing of the visual field without glaucomatous symptoms*. The ophthalmoscope reveals the most striking changes; the retina, more especially about its peripheral parts, is dotted more or less thickly with black pigment spots; these spots appear somewhat like a multitude of small black spiders with many legs; they have also been likened to bone-corpuscles. The spots of pigment appear to follow the course of the blood-vessels of the retina, and, as before stated, are collected most thickly in its peripheral parts.

The blood-vessels themselves are much diminished in size and visible number, and the optic disc is markedly anæmic.

Albuminuric retinitis.

Albuminuric retinitis is a peculiar form of retinitis met with in Bright's disease. The changes which take place in the retina are inflammation with effusion and hæmorrhages, followed by fatty and fibrinous degeneration of its structure, and subsequent atrophy.

The ophthalmoscope shows, in the early stages of the disease, retinal hyperæmia (more especially venous) with increased vascularity and redness of the optic disc. Next the retina becomes cloudy (more especially around the optic disc, the outline of which becomes obscured), and numerous hæmorrhages in the form of streaks and spots occur in various parts of its structure.

Characteristic appearances.

The cloudiness goes on increasing, and obscures the smaller vessels; later in different parts of the fundus, but mostly in a ring situated at a little distance from the margin of the disc, appear glistening white spots and patches; later the disc itself becomes grey and opaque.

Changes in yellow spot.

Whilst the above changes are going on in other parts of the retina, characteristic appearances may be developed in the region of the yellow spot. A number of small white glistening spots, which, however, do not coalesce so as to form a patch, but remain distinct, make their appearance. These glistening spots are arranged in a somewhat radiated position around the macula as a centre, and somewhat resemble a constellation; the appearance is quite characteristic, and once seen is not likely to be forgotten.

As the opacity of the retina increases, the vessels become more and more obscured, so that when the disease has reached its height only a few large venous trunks are still visible. Fresh hæmorrhages may occur at any time, and cover over and obscure the opaque portions of retina. After a time a retrograde process sets in, the hæmorrhages and peculiar opacity slowly disappear, the retina being at length left in a state of atrophy. Displacement of the retina may occur.

Albuminuric retinitis is usually associated with granular kidney; it is dependent on the blood-vascular disease (arterio-capillary-fibrosis, Gull and Sutton), of which the kidney affection is only a part. The

initis often appears before any sign of kidney mischief is manifested, l it is the ophthalmic Surgeon who first discovers the nature of the e.

Leucæmic retinitis.—A peculiar form of retinitis, somewhat resem- Leucæmic retinitis.
ng the albuminuric, has been described as occurring in connection h leucocythæmia.

Leucæmic retinitis is marked by pallor of the optic disc, a peculiar e colour of the retinal vessels, hæmorrhages, some opacity of the ina around the optic dics, and white glistening spots similar to those t with in albuminuric retinitis, which, however, are situated in the ipheral parts of the retina.

Embolism of the retina.—A form of retinitis associated with plug- Embolism of retina.
g of the central artery comes on suddenly without apparent cause, h complete loss of sight. Ophthalmoscopic examination shows some lor of the optic disc and diminution in calibre of the vessels emerg- from it, but the most marked change is seen in the region of the low spot.

The retina around the spot is grey and opaque, and numerous Changes about yellow spot.
od-vessels, not visible under ordinary conditions, come plainly into w; the macula itself is seen as a bright red spot (which might be en for a hæmorrhage by a careless observer) situated in the centre the opaque portion of retina.

The bright red appearance of the macula arises from the anatomical angement of the parts; the retina in this situation, being thin and nly bound down to the parts beneath, does not become infiltrated h inflammatory exudation, and consequently the normal red colour he fundus appears in striking contrast to the surrounding opaque na. Hæmorrhages may occur.

yphilitic retinitis.—A form of inflammation affecting the retina Syphilitic retinitis.
diately surrounding the optic disc has been looked upon by some syphilitic origin, but, like syphilitic iritis, rarely presents any characteristic signs. Should retinitis occur with other manifes- s of syphilis, congenital or acquired, it may be looked upon as litic.

EATMENT.—Both eyes should be kept thoroughly at rest, by Treatment of retinitis.
iting all near work, paralysing the accommodation by atropine, ielding the eyes from the stimulus of too bright light by neutral rotectors. Everything that is likely to cause disturbance ocular circulation, as stooping positions, excitement, stimu- oo rapid variations of temperature, &c., should be carefully

ple retinitis blood should be taken from the temples by leeches, Abstraction of blood.
rably, by the artificial leech, and in this form as well as in connected with syphilis mercury does good; it should be Mercury.
as quickly to affect the system either by the mouth, by or in the form of vapour baths. In cases of long stand- ver, small doses of the bichloride of mercury, taken regu- me months, may be beneficial. The other forms of retinitis secondary importance to the disease with which they are and against which treatment must be directed (*see* retinitis.). No treatment is of much avail in retinitis

of the Retina may be the sequel of inflammatory changes. Atrophy of retina.

Its principal characteristic seen with the ophthalmoscope is a condition of bloodlessness, in some cases associated with opacity of the retina, and frequently with atrophic changes in the choroid. Bloodlessness shows itself in a diminution of the visible number, and also of the calibre of the retinal blood-vessels, more especially of the arteries, some of which may appear pervious to red blood-corpuscles in part of their course only, their continuations being marked by a yellowish-white cord. Opacities, if they occur, are of a greyish-white colour, and situated for the most part around the optic disc.

Condition of optic disc.

The disc itself is frequently extremely anæmic or atrophied. (For treatment of atrophy of the retina, *see* Atrophy of the optic disc.)

Hæmorrhage into the retina.

Hæmorrhage into the retina.—Besides the form of hæmorrhage described as occurring in retinitis, bleeding may take place into the structure of the retina, from rupture of a retinal blood-vessel without previous inflammatory change. The hæmorrhage is usually considerable, and will be seen as an irregular patch of blood, situated somewhere in the course of the ruptured vessel, and often surrounded by inflammatory exudation.

The extravasated blood becomes gradually absorbed, but usually leaves behind it some indications of its previous existence.

Displacement of retina.

TREATMENT.—Rest of the eyes, protection from bright light, and blisters to the temples.

Displacement of the retina is associated with effusion of serous fluid between it and the choroid; it may be caused by blows on the eyeball or the head in its vicinity; it may occur without apparent cause, and is often met with in myopic eyes. Displacement of the retina occurs by preference at its lower part, but may vary in extent from detachment of a small fold to total separation of the whole retina from the choroid, the only points of attachment left being at the optic disc and ciliary processes.

Treatment.

The ophthalmoscope shows a grey, opaque, moveable cloud, over the surface of which the retinal blood-vessels can be traced.

TREATMENT.—Little can be done to remedy displacement of the retina, but an attempt should be made to procure absorption of the fluid by the administration of such drugs as iodide of potassium and mercury, and by the application of blisters to the temple. If the displacement occur in connection with myopia the anomaly of refraction should be carefully neutralised by suitable glasses, and in all cases rest should be insured to the eyes, so as to prevent as much as possible further detachment.

Optic neuritis.

Inflammation of the optic disc (optic neuritis, neuro-retinitis).—The ophthalmoscope shows a reddish-grey turbidity of the disc and the surrounding zone of retina, accompanied by swelling of the parts. The retinal veins are engorged, but their visible number is not increased; the arteries are thinner than usual, and all the vessels are more or less shrouded and concealed from view in the opaque portion of retina and upon the nerve surface. Numerous small hæmorrhages may occur upon the disc and around it.

Choked disc.

Ischæmia of the disc (choked disc).—Choking of the optic disc has been (and still is by some) looked upon as distinct from optic neuritis. It would, however, appear that the difference is one of degree only. The ophthalmoscope shows great swelling and an intense red colour of the disc, its outline being entirely lost; there is, however, but slight

swelling or opacity of the surrounding retina; small hæmorrhages are frequently seen on the nerve surface. The retinal veins are enormously distended, their course extremely tortuous, and they may be varicose; their visible number is also considerably increased. The arteries are thinner than natural or of normal calibre; none of the vessels are shrouded and concealed from view, as in neuritis. Ischæmia may go on to neuritis.

In many cases of neuritis and choked disc sight is unaffected; in others vision is much impaired or reduced to perception of light only.

Optic neuritis and ischæmia may be looked upon as indicative of irritation of the nerves in some part of their course, as would occur in meningitis, or of obstruction to the venous circulation resulting from pressure directly on the main trunks, as in cerebral tumour, or from any form of disease whatever which causes *over-crowding* of the contents of the cranium. Both neuritis and ischæmia are usually bilateral.

Treatment.

TREATMENT.—Optic neuritis and ischæmia of the disc are of only secondary importance to the disease which gives rise to them; they are of much greater interest to the physician than to the oculist, as their existence enables him to diagnose cerebral lesion with great certainty. The cerebral lesion is, however, often syphilitic, and it may be laid down as a rule, seldom to be departed from, that optic neuritis and ischæmia call for the administration of iodide of potassium or mercury in full doses.

Atrophy of optic nerves.

Atrophy of the optic nerve may be the result of preceding neuritis, when it is called "consecutive atrophy," or the atrophy may have commenced as such, and slowly progressed without inflammatory change, "simple atrophy."

Atrophic cup.

With the ophthalmoscope the optic disc will be seen to be white or bluish white in colour, frequently its margin appears irregular, and it may be cupped. The atrophic cup varies from the glaucomatous in not having steep sides, so that the vessels do not appear broken in their course as in the latter affection; it does not take in the whole nerve, but only its central part, which slopes gradually backwards; the vessels appear curved on the surface of the disc, but are not altered in calibre as in glaucoma. Atrophy of the retina frequently goes along with atrophy of the optic disc.

State of vision.

In cases of atrophy of the optic nerves vision is always much impaired; some patients with extremely white discs can count fingers, distinguish large letters, or even read ordinary print, but in the majority of cases vision is reduced to bare perception of light.

Treatment.

TREATMENT.—The treatment of atrophy of the optic nerves, especially if associated with a similar condition of the retina, is most unsatisfactory, and, indeed, almost hopeless. Should a certain amount of vision still remain, and no change have taken place for many months, we may safely assure our patient that he will retain what sight he has. The drugs which have been principally used are iron, either alone or in combination with nux vomica, strychnia taken by the mouth or injected hypodermically, phosphorus, quinine, or other tonics, and opium in gradually increasing doses. Galvanism has also been employed.

Occurrence of inflammation.

Inflammation, once set up, may subside shortly, leaving no trace behind it; it may continue until more or less irreparable damage has been done, or may run on to suppuration of portions or the whole of the globe; the cornea is more liable to this change than any other structure.

Time of onset.

The symptoms of inflammation usually appear within the two days immediately succeeding an operation, and little fear need be entertained for the safety of the eyeball if all has gone well for a week.

Occasionally, after cataract extraction, eyes have been lost through inflammation, or suppuration commencing at a later period, but these cases are rare, and probably it will be found that some damage has been done to the eye shortly before the symptoms appeared.

Treatment of inflammation.

The treatment of inflammatory changes consists in the local abstraction of blood from the temple by leeches, or the application of the artificial leech; the use of fomentations of water, poppy-heads, or belladonna constantly applied; the administration of opium in full doses, either alone or combined with mercury. The treatment must, of course, be varied according to the condition of the patient; should he be weakly and anæmic, we should be careful about bloodletting, and instead quinine and iron, with good living and a fair amount of stimulants, should be prescribed.

The local abstraction of blood, however, acts most beneficially in relieving pain, and should therefore be employed in cases where pain is a prominent symptom, even though the patient does not appear to have much blood to lose. Strong healthy patients should be leeched freely, and kept on light diet.

Pressure.

During the treatment the eye must be kept carefully closed and bandaged, excepting during the time that fomentations are being applied. Moderate pressure by carefully applied pads of lint and cotton wool, secured by a few turns of flannel bandage, is said to exert considerable influence in cases where the cornea is threatened by suppuration; it should have a fair trial, if pressure can be borne.

If the inflammation go on to suppuration of the whole globe the case must be treated in the same manner as abscess in any other part (*see* Ophthalmitis).

Insertion of seton.

Insertion of a seton in the temple.—In order to place a seton in the temple, the position of patient and operator should be as in Fig. 93, p. 396. The operator should pinch up the skin with the finger and thumb of one hand, just in front of the patient's ear, and pass a seton needle armed with a double thread of stout silk through the fold thus produced; the silk should be drawn through and tied in a short loop. The seton should pass for about 1¼ in. beneath the skin, and should be placed amongst the hair, so as to avoid as much as possible disfigurement from the subsequent cicatrix; the silk should be drawn backwards and forwards through the wound every morning; it may be left in as long as appears necessary.

Wound of temporal artery.

Care must be taken in passing the needle not to wound the temporal artery; should this accident happen the seton must be removed and firm pressure applied with a pad and bandage.

Artificial leech.

Application of the artificial leech.—This instrument consists of a small sharp steel cylinder (worked by a spring arrangement), with which a circular incision can be made through the skin of the temple, and a hollow glass cylinder, which can be placed over the wound, and

: air in its interior exhausted by means of a piston worked by a ew; as the air is removed the blood flows up to fill the vacuum. re must be taken not to work the screw too quickly, but only to ve the piston at the same rate as the blood flows; neither must e edge of the cylinder be allowed to compress the skin against e parts beneath, otherwise the flow of blood will be impeded.

THE EYELIDS.

Tumours.—Various small growths are met with about the eyelids.

Molluscum. **Molluscum** occurs as a small yellowish-white projection, having a pressed and often blackened centre, situated on some part of the in of the lids; there may be only one or many of these little growths. ey can be easily removed by thrusting a knife through them, and en squeezing out the contents with the thumb nail.

Congenital sebaceous cyst. **Dermoid cysts** are not unfrequently met with situated deeply beneath e skin and the muscle, often near the outer angle of the orbit. They e congenital, filled with sebaceous matter, and often contain hair. ey must be carefully dissected out, much more trouble being experi- ced in so doing than would be at first suspected, and they will in all obability be opened during removal. These little tumours will be nd attached deeply to the periosteum, and may have caused a pression in the bone.

Warts. **Warts** are not unfrequently met with about the eyelids; they should cut off with scissors.

Tarsal cyst. **Tarsal cyst** is met with as a dusky red or colourless projection from e outer surface of the lid; its position is marked on the conjunctival rface by a bluish spot, from which a granulation is occasionally seen owing. The cyst is formed by obstruction of a Meibomian gland d retention of its secretion; it is sometimes in a suppurating ndition.

Treatment. The lid should be everted, the cyst freely opened from the conjunc- val surface with a small knife, and its contents squeezed or scooped t; it must be thoroughly emptied, or it will, in all probability, -form.

Filling of cavity with blood. The cavity left on removal of the contents of the cyst will always ll with blood, and shortly after the operation the tumour will be as rge or larger than before; the patient must be warned of this. The swelling will most probably disappear in the course of from ur to six weeks; if it remain longer the operation should be peated.

Chalazion. A tarsal cyst sometimes degenerates into a hard fibrous little mass, eling somewhat like a large shot beneath the skin, which is known s a *chalazion;* this should be dissected out through an incision in he skin of the lid, which should afterwards be closed by a fine suture. **Treatment.**

Xanthelasma. **Xanthelasma** is often met with as a small yellow patch on some part f the skin of the eyelids; its most frequent site is the surface of the pper lid near the inner canthus. The little patch may be excised if t is a source of anxiety to the patient.

Simple cyst. **Simple serous cysts** occur about the margins of the lids; they are bout the size of small peas, and nearly transparent. A portion of he cyst wall should be cut out with scissors.

Trichiasis signifies a faulty direction of the eyelashes, which turn

inwards and irritate the cornea; it is usually caused by contra
the conjunctiva (following granular ophthalmia or its unskilf
ment), producing displacement of the hair *follicles*.

Treatment. Only a few lashes may be misdirected, or the whole row
inverted. If only a few of the lashes turn inwards, it is suffi
pull them out with forceps whenever they become troublesom
considerable number or the whole row are inverted, their root

Operation. be removed by operation. The operation should be performed
lows:—The patient being placed in the usual position (*see*
p. 396), the lid should be secured by a compressorium forceps (
96), by which means it is steadied and hæmorrhage preven
must be taken not to screw the instrument up too tightly, or sl
of the lid may follow. The lid being well secured, the operato
make an incision through the skin, about three lines from
margin of the lid and parallel with it, of such a length as
spond to the lashes which are misplaced; the incision sh
carried down to the outer surface of the tarsal cartilage; a
incision should then be made of the same length as the firs
margin of the lid, and so conducted as to split the lid and
the skin and hair-bulbs from the subjacent structures; the
the two incisions should then be joined by two short cuts,
portion of skin included with the hair-bulbs dissected off th
cartilage. The raw surface should then be wiped with a spo
any black dots denoting the presence of hair-bulbs carefully re

FIG. 95.

Compresso-
rium forceps.



Compressorium forceps.

FIG. 96.



Compressorium forceps applied.

The compressorium forceps should then be unscrewed, when sl
hæmorrhage will take place. The eye must be covered by two
of wet lint secured by a turn of bandage.

Entropion. Entropion signifies a rolling inwards of the whole lid, the whi

lashes being completely turned towards the eyeball; it is most quently met with in the lower lid, more especially in old people h a superabundance of loose skin about the face. It is often the se of much trouble and annoyance, as well as of danger to the eye, er cataract extraction.

The inversion may be caused either by spasmodic contraction of the icularis muscle or by distortion and thickening of the tarsal cartilage er granular ophthalmia.

From spasmodic contraction of orbicularis.

Entropion caused by contraction of the orbicularis is easily remedied as follows:—The patient, lying on a couch (*see* Fig. 94, p. 396), the rator should seize with forceps the skin of the lid at a point near or other canthus, about two lines from its margin, and then with sors remove a portion in breadth corresponding to about half the face of the lid, and extending along its whole length; he should n seize and remove the orbicularis muscle to a corresponding ex- t; no suture need be used; the eye should be bound up with wet and a bandage. The subsequent healing of the wound and con- ction of the cicatrix will remedy the inversion.

From distortion of tarsal cartilage.

Entropion depending on distortion and thickening of the tarsal car- ge is usually met with in the upper lid. It can be remedied by oval of a wedge-shaped piece of cartilage, including the more kened portion, by the following operation:—The patient, being in usual position (*see* Fig. 94, p. 396), and the lid fixed by a compres- ium forceps, with a sharp knife an incision should be carried through whole thickness, parallel with and about two lines distant from its rgin, along the whole extent of the thickened portion. A some- t lunated incision should then be made from one end of the first nd the base of the thickened portion of tarsus joining the first ion at its other extremity; the second incision should not be d vertically through the cartilage, but obliquely, so as to meet rst at the conjunctival surface; the portion of cartilage included en these incisions should then be removed, the wound closed by s, and the eye bound up with lint and a bandage. The skin uscle covering the cartilage may be removed or not, according to cy of the Surgeon. If their removal is not desired, they should ected back before making the second incision. After the opera- margin of the lid should appear rightly directed.

Removal of portion of tarsal cartilage.

Ectropion.

pion signifies an everted condition of the lid; the extent of varies in different cases, from slight falling away of the margin id from the globe to eversion of the whole extent of the lid ning fornix of the conjunctiva.

From distension.

ghter forms are caused by distension of the lid from inflam- welling, and are easily remedied by slightly narrowing the aperture, by paring the edges of the lids near the outer nd bringing the raw surfaces together by a suture, when firm take place between the two.

From contraction of cicatrices.

e extreme forms are caused by the contraction of cicatrices ounds, or inflammatory changes, about the orbit.

te rules can be laid down with regard to the treatment of The Surgeon must be guided by the conditions as they selves, and do the best he can.

, if the tarsal cartilage be left entire, it should be care- d away from its attachments and replaced as nearly as

possible in its normal position, in which it must be kept by paring its margin and that of the opposite lid, and securing extensive and firm union between them by careful coaptation of their raw surfaces. The lids must not be opened until all further contraction of the original cicatrix is at an end, and it is better to leave the eye closed for considerably too long a period than to open it a day too soon. Ectropion is also frequently seen in the more severe forms of ophthalmia, or in cases of severe intolerance of light, and is specially liable to occur when an attempt is made to open a firmly closed eye. In these cases the eversion requires no special treatment, but disappears as the affection causing it is recovered from.

From photophobia.

Formation of new lid.

Formation of a new eyelid.—In some cases of burn, or from ulceration of a lupoid character, more or less complete destruction of the eyelids may take place. To remedy this defect, a flap of skin from a neighbouring part may be brought, placed in the gap, and there secured by means of sutures, care being always taken that the piece of skin is considerably larger than the surface it is intended to cover. Before removing any skin, search must be made in any portion of the eyelid that may be left for the tarsal cartilage, and if this be found it must be carefully dissected out and preserved, its natural form being as much as possible restored; it should be fixed in its proper position by uniting its margin to that of the opposite lid. Even if no flap of skin be applied over it, it will in time become covered with cuticle, and form a very effectual covering to the eyeball.

Preservation of tarsal cartilage.

Symblepharon.

Symblepharon signifies adhesion of the conjunctiva of the eyelid to that of the globe. It is usually caused by burns with lime or hot metal, and may occur to any extent, varying from a thin band of union to fusion of the greater part or whole of both lids with the globe.

Bands of adhesion.

This condition requires to be remedied by operation. Where only a thin band of adhesion exists it should be first carefully secured by a suture passed through the extremity nearest the eyeball and then be divided, and drawn into the fornix by passing the suture through the lid and securing it to a small roll of strapping, placed upon the cutaneous surface. By this means the raw surface left by removal of the band from the globe is brought into contact with healthy conjunctiva and granulates over, healing without forming adhesions.

If more than one band exist, each should be dealt with separately.

Extensive adhesion.

Cases of more extensive adhesion give rise to the utmost difficulty in treatment, and until lately the operations performed for their relief were attended with only indifferent success. One plan of treatment recommended was to dissect away the adhesion and interpose a shell of glass between the raw surfaces, but as healing invariably commenced at a point remote from the free margin of the lid, the shell was gradually pushed out and the adhesion re-established.

The insertion of pieces of wire deeply beneath the adhesion, which were left in until the walls of the canal made by them had healed, the remainder of the adhesion being then divided with scissors, was followed by no more satisfactory results.

Teale's operation.

Lately, an operation has been introduced by Mr. P. Teale, of Leeds, which has been attended with the best success. The operation has for its object the separation of the raw surfaces by a piece of conjunctiva taken from some other part of the eyeball. The following is an extract from the account of the operation given by Mr. Teale in the 'Transac-

ons' of the Fourth Ophthalmic Congress, 1872. "The patient being
nder the influence of an anæsthetic, the eyelid is freed from its attach-
ent to the lid; next, a band of somewhat circular form is marked
t, with a sharp knife, upon the sound conjunctiva; the band com-
ences at one end of the gap left by liberation of the lid, and passes
und the sound side of the cornea, terminating at the opposite ex-
emity of the gap.

"Four stitches are then inserted, two on each edge of the flap thus
rmed. The flap is next separated on its *under surface*, whilst its ex-
emities are left continuous with the conjunctiva; it is then drawn
ross the surface of the cornea, and fixed, raw surface downwards,
to the gap formed by the liberation of the eyeball from the lid; it
secured in its new position by the sutures already alluded to, aided
as many others as may appear necessary."

Mr. Teale states that "the operation is most tedious," and that he
rely completes it within the hour.

Anchyloblepharon signifies an adhesion of the lids to each other. The adhesions must be divided with scissors, and, if possible, some skin or conjunctiva interposed between the raw surfaces; but if this cannot be done, reunion may be prevented by passing a probe between the lids daily. Anchyloblepharon.

Narrowing of the palpebral aperture (Blepharophymosis) is usually a result of granular ophthalmia, and is accompanied by entropion, displaced tear puncta, and consequent watering of the eye. It requires to be remedied by operation, which can be thus performed:—The lids being kept widely open and on the stretch by a wire speculum (Fig.), an incision should be made with strong scissors through the outer thus. A flap of conjunctiva, of somewhat conical shape, should n be marked out on the surface of the eyeball, the flap freely sected from the subjacent structures, but left attached at its base, ich is towards the cornea, and then fixed by sutures in the incision le by the scissors, in such a manner as to keep the raw edges rated by a mucous surface. Blepharophymosis.

Fig. 97.



Wire speculum.

metimes necessary to narrow or close entirely the palpebral This operation, known as *tarsoraphy*, can be performed as —The lid being held with forceps, a portion of *the inner edge* rgin should be removed with a small iridectomy knife, taken not to cut away any of the outer edge containing nor to wound the tear puncta or canaliculi. The opposite then be treated in the same manner, and the raw edges Tarsoraphy.

brought together by sutures; firm union will soon take place b
them.

Ptosis. **Ptosis** signifies a drooping of the upper eyelid to a greater
extent, with inability to raise it. Ptosis occurs with divergen
bismus and more or less impairment of the mobility of the eye
cases of paralysis of the third nerve, and is generally, but not
ably, accompanied by dilatation and fixity of the pupil.

It is also met with as a congenital defect, and occurs som
after severe inflammation of the lid, or protracted intolerance of
and constant spasmodic action of the orbicularis muscle. Wom
the middle period of life, with a superabundance of loose skin
the face, are also subject to a form of partial ptosis.

Treatment. TREATMENT.—In ptosis from paralysis of the third nerve tre
must be directed against the cause of the paralysis, no operatio
advisable; other forms can be remedied by removal of some sk
orbicularis muscle from the surface of the lid.

Operatio ptosis. The operation may be performed as follows:—The skin at the
part of the lid should be pinched up with forceps, the amount in
between their blades being such as to raise the margin of the l
above the upper border of the pupil. Then with scissors a s
skin of the required width should be removed, along the whole
of the lid, parallel to its margin; the orbicularis muscle should t
cleanly dissected off the tarsal cartilage to about the same exte
wound closed by one or two fine sutures, and the eye bound u
wet lint and a bandage.

The wound will heal in the course of a few days, and the shor
caused by the removal of the skin and muscle, and subsequen
trization (possibly aided by the entanglement of some fibres
occipito-frontalis in the scar) should keep the lid in the desired po

In cases of congenital ptosis we often find movement of th
upwards greatly impaired; it seems probable that the superior re
badly developed or altogether absent.

THE LACHRYMAL APPARATUS.

Lachrymal gland. **The lachrymal gland** is occasionally the seat of malignant or
growths, and may require extirpation.

Cysts. **A cyst** is sometimes met with caused by obstruction of one
ducts of the gland and accumulation of secretion. The dise
known as *dacryops*.

Treatment. Its treatment consists in establishing an opening into it fro
surface of the conjunctiva; this is easily done by passing a c
needle armed with silk from beneath the upper lid through the w
the cyst into its cavity, and out again at a convenient distance
silk should then be drawn through, and the portion of cyst-wa
cluded between the entrance and exit of the needle firmly ligat
the ligature will slough out and leave a permanent opening, caus
inconvenience. If the cyst be opened through the skin it may le
troublesome fistula.

Tear puncta and canaliculi. **The tear puncta and canaliculi.**

The tear puncta in the normal condition lie in contact with the
conjunctiva; they may be either everted, as seen in old and neg
cases of tinea, or rolled somewhat inwards; they are sometimes f

tirely obliterated, either by disease or injury, burns of the eyelids ing the most common cause.

The canaliculi may also be found more or less obstructed in any part their course, at times by a little mass of fungus. Any of these nditions are accompanied by troublesome watering of the eye, piphora." They can be remedied by slitting the tear puncta and naliculi.

Lachryl sac.

The lachrymal sac is often the seat of acute inflammation, which may se in the sac itself, spread to it from the conjunctiva, or be caused disease of the surrounding bones. It is characterised by a dusky l, tense swelling, situated at the side of the nose, close to the inner nthus, the swelling and redness often extending outwards along both e upper and lower lids; one or both sacs may be affected. The in- mmation may end in resolution or go on to the formation of an scess; in the latter case, the swelling becomes soft and fluctuating.

Inflamm tion.

Abscess.

Treatment.

Treatment.—At first, hot fomentations and poultices must be ap- ed, and attention paid to the general health; if abscess form, the pus ust be let out by a free incision. If an abscess of the lachrymal sac allowed to burst a fistulous opening will very probably be left, but a free opening be made so soon as the formation of pus is suspected, e wound heals readily.

Mucocele.

Distension of the lachrymal sac (Mucocele).

The lachrymal sac not unfrequently becomes distended, forming a nour of varying size beneath the internal palpebral ligament (tendo ali); pressure on the tumour causes the escape of a transparent, newhat tenacious fluid, consisting of mucus and tears, in some es thickened from the admixture of pus-cells. Distension of the is caused by stricture of the nasal duct and consequent accumula- of secretion; it is accompanied by more or less watering of the and may be remedied by relieving the stricture of the duct.

Blennorrhœa.

ischarge from the lachrymal sac (Blennorrhœa).

muco-purulent or purulent discharge from the sac is often met following inflammation, especially if disease of the adjacent bone It may be treated—1st. By insuring a free exit for the discharge itting the canaliculus, and passing a large probe down the la- al duct. 2nd. By washing out the sac. 3rd. By obliteration of c.

Stricture of nasal duct.

cture of the nasal duct may be met with in any part of its the obstruction, however, is most frequently found at its junc- th the lachrymal sac. Occasionally the duct is found almost ted by dense bony deposit.

Fistula of lachrymal sac.

la of the lachrymal sac occurs as a small, sometimes scarcely ble opening, situated at some point over the sac; it is found ction with obstruction of the nasal duct. If the passage be shed, the fistula will probably close.

ions on the tear passages.

eration of slitting the tear puncta and canaliculi may be thus:—The patient should be seated in a chair, the operator behind him (*see* Fig. 93, p. 396). Supposing the lower nd canaliculus on the right side to be operated on, the small ngers of the left hand should be placed upon the patient's the outer canthus, the lids drawn tight, with these two kept so; then a small grooved director (Fig. 98) should be

Slitting canaliculus.

taken in the right hand and passed at first vertically to the margin of the lid, through the tear punctum; its handle then depressed, and its point passed horizontally along the canaliculus into the sac. To ascer-

FIG. 98.



Grooved director for slitting canaliculus.

tain that the point of the director is in the sac, the tension of the lids must be relaxed and the director pushed gently onwards; if there be any puckering at the inner canthus when the director is thus pushed, its point has not entered the sac, and a further attempt must be made; if no puckering occur, the lids should be brought again into a state of tension, and the handle of the director transferred to the thumb and forefinger of the left hand; a cataract or any small knife that will cut should then be taken in the right hand, and run along the groove of the director well into the sac, the knife and director being then withdrawn together; the upper lid must be kept out of the way by one of the fingers of the right hand. The operation can be performed on the left side in the same manner, with the exception that the hands are reversed.

The upper punctum and canaliculus sometimes require to be slit; this operation is not quite so simple as that on the lower lid, but is performed in much the same way. In lieu of the grooved director and knife, a small probe-pointed canaliculus knife may be employed; it should be passed through the tear punctum and canaliculus in the same manner as the director, and will cut its way out as it goes.

After-treatment.

The patient must be seen at intervals of two or three days for a week, or longer, after the operation, and a probe passed along the incision to prevent its closing.

Probing nasal duct.

Probing the nasal duct.

Bowman's probes.

For the treatment of stricture of the nasal duct a set of silver probes (Bowman's) are used: there are three probes in a set, the two extremities of each being of different thicknesses, so that there are six sizes, No. 1 being the smallest, No. 6 the largest.

Passing probe.

To pass a probe down the nasal duct, the canaliculus should be first slit, or, what is better, should have been slit at some previous time. The Surgeon should stand behind the patient in the same position as for performing the last operation; and the lids being made tense in the same manner, the probe should be passed along the slit canaliculus until the point is well within the sac, as shown by the absence of puckering at the inner canthus on relaxation of the tension of the lids; the opposite extremity should then be raised along the margin of the orbit until the probe has attained a vertical direction, care being taken, while so doing, to keep the end which is in the sac pressed firmly against its inner side; the probe, having been brought into a nearly vertical position, should be pushed gently but firmly downwards and slightly backwards and outwards in the direction of the duct; when it has been passed as far as it will go it should be slightly withdrawn, so as to raise its end off the floor of the nose. If the probe has been properly passed down the duct its upper part will remain firmly in contact with the margin of the orbit; but if it moves freely about, the probe is not in the duct, but has been forced through its wall. This

little accident is of no particular moment, and needs only that the probe be withdrawn and passed afresh in the right direction.

If the end of the probe is not well within the sac before an attempt is made to pass it down the duct, it may slip backwards into the orbit, or forwards and downwards in the cellular tissue of the cheek. A probe having been satisfactorily passed, should be left in for about twenty minutes, and the operation be repeated about twice a week. The treatment of stricture of the lachrymal duct is, on the whole, unsatisfactory, but the probing should be carefully and perseveringly carried out. It is well always to commence with the largest probe (No. 6), and try a smaller one if this cannot be passed. Accidents.

Washing out the lachrymal sac. Washing out lachrymal sac.

For washing out the lachrymal sac a good syringe fitted with nozzles of different sizes is required. One of the nozzles should be fitted to the syringe, which has been previously filled with fluid (water, a weak solution of nitrate of silver, chloride of zinc, &c.), the nozzle should then be passed along the previously slit canaliculus into the sac and the fluid injected; the patient's head must be bent forwards during the injection, or the fluid will run back along the floor of the nose into the pharynx.

Obliteration of the lachrymal sac. Obliteration of lachrymal sac.

In some cases of obstinate discharge from the sac, especially if dependent on diseased bone, the discharge may be stopped, and the patient made more comfortable by closing up the sac entirely; of course, more or less watering of the eye will remain after the operation, but is far to be preferred to the annoyance of a constant purulent discharge.

Obliteration of the sac may be attempted in any of the three following ways. A free incision having been made into it, and the blood carefully sponged out, its lining membrane may be destroyed—(1) by filling its cavity with a thick paste of chloride of zinc and starch, in equal parts, enclosed in a small piece of lint; (2) by the application of nitrate of silver, or (3) by the galvanic or other cautery. By any of these procedures adhesive inflammation is set up, more or less obliteration of the sac following.

Operations for obliteration of the lachrymal sac are by no means always successful, and may have to be repeated, perhaps more than once, before a satisfactory result is obtained.

THE CONJUNCTIVA.

The conjunctiva.

But few operations are performed on the conjunctiva alone, it is, of course, cut in some of the operations on the eyelids and in that for strabismus, and some others.

Warts are occasionally found on some part of the membrane; they require to be removed with scissors. Warts.

Pterygium is a peculiar, somewhat triangular growth, the base of which is situated in the ocular conjunctiva generally near the inner canthus, the apex encroaching more or less upon the margin of the cornea, or passing for a considerable distance upon its surface. The growth is of a reddish colour and variable density; it consists of hypertrophied connective tissue. Pterygium.

Pterygium is not common in this country, and when met with is usually found to occur in sailors and others who have been in the East.

Should it give rise to any inconvenience or threaten to impair vision it must be removed by operation.

Transplantation.

The patient should lie on the couch, the lids be opened by a wire speculum, the growth seized with toothed forceps and with a cataract knife dissected up from the surface of the cornea. A small portion of conjunctiva should then be removed parallel with the margin of the cornea, and the apex of the growth fixed by a suture in the wound. The eye should be kept bound up for a few days with wet lint and a bandage.

If a pterygium is simply cut off it will, in all probability, grow again, but if transplanted it will shrivel up, and disappear without giving further trouble. A cicatrix always remains upon the cornea after removal of pterygium, so that it must never be allowed to grow over the pupil.

Pinguicula.

Pinguiculæ are small yellowish growths situated beneath the conjunctiva, generally near the outer and inner margins of the cornea; they are surrounded by a few large blood-vessels, and are occasionally the source of constant irritation, causing the eyes to be bloodshot and uncomfortable. Pinguicula can be removed, if desired, by making an incision over it, turning back the conjunctiva, then seizing the little growth with forceps, and dissecting it away from the parts beneath. The growth having been removed, the conjunctiva should be closed over the wound by a suture, and the eye kept bandaged for two or three days after the operation.

Fatty tumour.

Lipoma is met with as a tumour projecting beneath the upper lid, near the fornix, and often between the superior and external recti muscles; it somewhat resembles a third lid. If the tumour gives any trouble it must be removed by operation, thus:—The patient lying on the couch, the lids should be kept as widely open as possible by a wire speculum, an incision made with a cataract knife through the conjunctiva over the tumour, and its most projecting portion seized with toothed forceps and removed with scissors; care must be taken not to drag upon the growth, as it is continuous with the fat in the cavity of the orbit, a great portion of which might be pulled out. As much of the tumour as is thought necessary having been removed, the conjunctiva should be closed over it with sutures, and the eye bound up.

Nævus.

Nævus occasionally occurs in the conjunctiva; it may be removed by the knife, or destroyed by the galvanic or other cautery, in the latter case due precautions must be taken to guard the eyeball from injury during the operation, and to prevent as much as possible the evils arising from subsequent cicatrisation.

Cancerous ulcers.

Cancerous ulcers may also be met with; they must be thoroughly extirpated, the eyeball being excised, if necessary.

Cysts.

Cysts containing a clear serous fluid are occasionally met with in the conjunctiva; they must be punctured, when they at once subside, but sometimes re-form, in which case a portion of the cyst-wall must be excised, or a fine seton passed through it.

Cysticercus.

Cysticercus also occurs, and should be treated by incision of the cyst.

EXTERNAL MUSCLES OF THE EYEBALL.

Strabismus.

Strabismus (squint).—"Strabismus is a deviation in direction of the axes of the two eyeballs, in consequence of which the two yellow spots receive images from different objects. In convergent strabismus the two visual lines do not cross each other at the point it is desired to ob-

serve; only one of the two, that of the undeviating eye, reaches it. Under this deviation not only does the expression of the face suffer from want of symmetry in its most eloquent parts, but the power of vision, at least in one of the eyes, is usually disturbed, and the squinter always loses the advantage of binocular vision." (Donders.)

Causes.

Strabismus must not be looked upon as a special form of disease; it is in by far the greater number of cases associated with some anomaly of refraction, which, being the primary cause of the deviation, gives rise to the strabismus; other conditions which may induce strabismus will be subsequently considered.

Varieties.

Two forms of squint are commonly met with. 1. Convergent. 2. Divergent. Other rare forms are superior and inferior strabismus; these will receive no further notice.

Convergent strabismus is the most common of all, and is almost always the result of hypermetropia.

Divergent strabismus is usually the result of myopia.

Convergent strabismus.

Convergent strabismus, as just stated, is nearly always the result of hypermetropia. The question naturally arises, How does hypermetropia produce it?

Connection with hypermetropia.

The hypermetropic individual must always accommodate strongly when looking at even a distant object; and as the object is brought nearer, the tension of accommodation must be correspondingly increased. As stated at page 359, accommodation is associated with convergence of the visual lines. Now, the greater the degree of convergence the more strongly is the accommodation brought into play; consequently there is an ever increasing tendency on the part of the hypermetropic individual to converge too much, in order to bring his accommodation into the highest possible state of tension. If the convergence of the visual lines be excessive, or if they do not meet in the same point, convergent strabismus results.

The question next arises, Why do not all hypermetropic individuals squint? The reason is that if both eyes are of the same refraction, and have equal acuteness of sight, there is always such a desire to maintain binocular vision that the visual lines will remain directed to the same point, even though the eyes are not accurately accommodated for that point, the individual being content with ill-defined retinal images rather than sacrifice binocular vision by increasing his convergence.

But if vision of one eye be less acute than that of the other, or if there be a difference of refraction between the two, the desire for binocular vision is lost, or its value very much lessened, and the necessity for a well-defined image on one retina is immediately felt. The accommodation is put fully on the stretch, and with it the degree of convergence becomes excessive, both visual lines being directed to points nearer to the eyes than that for which they are accommodated, the deviation of the more defective eye being greater than that of its fellow.

Ordinary convergent or "concomitant" squint has to be distinguished from squint the result of paralysis, "paralytic" squint. This may be done by noticing the relation of the convergence of the eye which is observed to be squinting—"primary" squint—to the deviation—"secondary squint"—which occurs in the properly directed eye when it is covered and an attempt made to fix an object with the

squinting eye. In concomitant squint the primary and "secondary" deviations are equal; in paralytic squint the "secondary" deviation is greater than the "primary."

Treatment.

TREATMENT.—Slight cases of convergent strabismus, especially if the deviation is not constantly present but only occasional (periodic squint), may be cured by the use of glasses which accurately neutralise the existing hypermetropia.

Periodic strabismus.

In more severe cases division of the internal rectus tendon in one or both eyes is necessary.

It is often difficult to decide whether only one or both eyes shall be operated on.

If it is found that one eye squints habitually and to no great extent, the other being always used for fixing an object, division of the internal rectus of that eye which habitually deviates alone is necessary.

Alternating strabismus.

If each eye deviates alternately (alternating strabismus), and to no great extent, division of one internal rectus may be sufficient; but if three weeks or a month after the operation the squint still continues, tenotomy of the internal rectus of the other eye should be performed.

If one eye squints considerably and habitually, or if the deviation is excessive and alternating, the internal rectus in both eyes must be divided. In any case, if there be a doubt as to whether one or both eyes should be operated on, it is well to be on the safe side, and do only one at a time.

Operation for convergent strabismus.

Operations for convergent strabismus.

There are two principal methods of operating for convergent strabismus.

1. The operator should stand on the right side of the patient, placed in the usual position (Fig. 94, p. 396), and the eyelids being kept well open with a wire speculum, should seize the conjunctiva and subconjunctival fascia with the toothed forceps (Fig. 99*a*) at a point about midway between the margin of the cornea and semilunar fold, and just below the inferior margin of the tendon of the internal rectus muscle. An incision should then be made with strabismus scissors (Fig. 99*b*) through the conjunctiva and subconjunctival fascia, well down to the sclerotic, and the strabismus hook (Fig. 99*b*) passed through the opening and inserted between the tendon and the eyeball. If properly introduced the hook will be brought up short at the insertion of the tendon into the sclerotic when it is pulled forwards; it should be held firmly in position, the scissors passed through the opening, one blade following the hook between the tendon and the eyeball, the other being kept outside the tendon, which is thus included between the two blades, and the tendon should then be divided by one or two sharp strokes with the scissors.

Division of the tendon.

The scissors may now be withdrawn, and the hook pulled forwards; if the latter meets with no resistance, but passes freely up to the corneal margin, the operation has been successfully performed; to make sure of this, however, the hook should be withdrawn, the search for hooking the tendon repeated, and any fibres that may have escaped division cut through.

Connection with subconjunctival fascia.

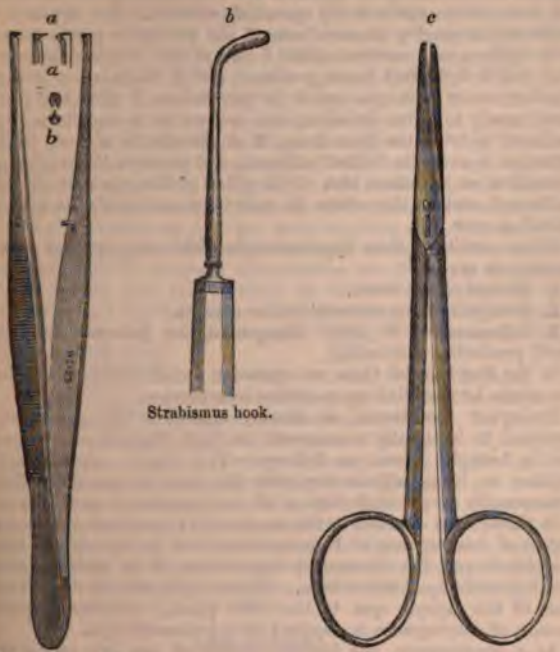
On the division of the tendon the muscle retracts, the retraction being limited by the subconjunctival facia with which it is immediately connected. If the eye is not properly directed after simple division of

endon, a greater effect may be produced by further freely severing nbconjunctival fascia.

In the second operation, the position of the patient and surgeon

Fig. 99.

Instruments for strabismus.



Strabismus hook.

oothed and fixing forceps. ner points shown in side view; *b*, front view.

Strabismus scissors.

uld be the same, and the lids be kept open with the wire speculum, in the one already described.

An incision should be made with scissors through conjunctiva and conjunctival fascia, over the insertion of the tendon, instead of below inferior margin; the tendon then picked up with the strabismus k, and divided close to the sclerotic. The wound in the conjunctiva uld be afterwards closed with a fine suture.

No after-treatment is required for strabismus operations; the patient y go about as usual and simply keep the eyes clean. But if, when eyes have quite recovered from the effects of the operation, re should be any return of the squint, the degree of hyper-tropia must be carefully ascertained, and glasses which thoroughly tralize it ordered to be used for all purposes. In most cases this l be found sufficient; but if after the glasses have been persever-

ingly worn for some weeks no effect is produced the operation should be repeated in one or both eyes.

Use of anæsthetics.

Use of anæsthetics in operations for convergent strabismus.

Whether anæsthetics should be employed or not in squint operations appears to be a matter of opinion; some eminent oculists never employing them, others again rarely operating without. For my own part, I prefer not to employ an anæsthetic if the patient is pretty steady, but with children and nervous adults I always use one, taking care, however, that a full effect is not produced, and if there is any doubt as to whether one or both eyes are to be operated on I allow the patient to come nearly to after finishing one eye, so as to ascertain the effect produced by what has been done; if an anæsthetic is given to such an extent as to exert its fullest influence, and produce thorough muscular relaxation, an erroneous idea of the effect of the operation is likely to be formed, and on the return of consciousness the squint may remain as bad as ever.

Other conditions causing convergent strabismus.

Other conditions than hypermetropia which may produce convergent strabismus are—

1. Disease of the brain.
2. Paralysis of the external rectus muscle.
3. Inflammatory or other changes in the internal rectus muscle itself, producing shortening.

In the first two of these no operation is advisable; the third may sometimes be remedied by operative interference.

Divergent strabismus.

Divergent strabismus, as already stated, is often the result of myopia; it is usually consequent on high degrees of the anomaly, and is brought about as follows:—The highly myopic individual requires to bring objects very near the eyes to see them distinctly, consequently a very high degree of convergence is necessary to keep both visual lines directed to the same point; now, not only has a high degree of convergence to be maintained, but in myopia the length of the eyeball and the consequent impairment of its mobility place the internal recti at a disadvantage. Moreover, in order to direct the visual lines of the myopic eyes to the same point, a greater proportionate amount of convergence is required than in emmetropia.

Causes.

As a consequence, the internal rectus of one eye sooner or later becomes wearied and gives in, and the eye deviates outwards, binocular vision being sacrificed.

Cure by glasses.

TREATMENT.—Many cases of divergent strabismus may be remedied by the use of concave glasses, which enable the individual to see distinctly at a distance up to which convergence of the visual lines can be maintained without undue strain of the internal recti muscles.

If in spite of the use of glasses the divergence continues, it must be remedied by operation. In cases where the eye only deviates outwards after an object has been looked at for some considerable time, subconjunctival division of the external rectus of the deviating or of both eyes may suffice for a cure; but in cases where one or both eyes diverge constantly, and the visual lines can only be made to meet in one point by a great effort, or not at all, the operation of "readjustment" is to be performed.

Division of external rectus.

Operation of readjustment.

This operation can be performed as follows:—The patient being placed in the usual position (Fig. 94, p 396) and thoroughly anæsthetised, the operator should stand behind, fix the lids open with

speculum; with scissors make an incision through the conjunc- and subconjunctival fascia, below the insertion of the external us; hook up the tendon, and divide it subconjunctivally close to sclerotic.

n incision should then be made through conjunctiva and subcon- tival fascia, about midway between the insertion of the internal us and inner margin of the cornea, of such a length as to reach it two lines above and a like distance below the margins of its ion, which should then be hooked up and divided. The muscle subconjunctival fascia should be freely separated from the parts eath, and together with the conjunctiva turned back towards the Introduction of sutures. ncle. Two curved needles holding fine silk should then be passed ugh the tissues next the margin of the cornea, and the silks ly tied, two free ends being left; the needles should then be ied from within outwards, through the muscle, subconjunctival ia, and conjunctiva, as near the inner canthus as possible, and the drawn through; a considerable portion of the muscle and other ues should then be removed with scissors, the free ends of the two pieces of silk and the portions to which the needles are still ched then tied firmly together (the eye being rolled well inwards an assistant as the knots are pulled tight), and the ends of the sutures cut off close.

he eye should be bound up with wet lint and a bandage. The ures will probably require removal in about four or five days, but be left longer, if they cause no irritation.

Divergent strabismus is met with in cases of paralysis of the third Other causes of divergent strabismus. ve, it may also occur in non-hypermetropic eyes if the sight of has become much impaired, and binocular vision no longer possible, may be caused by too free a division of the tendon in the operation convergent squint. In the first of these cases no operation is isable; in the second, no improvement of sight is to be expected n readjustment, but the operation may be performed simply to remedy igurement. In the third, readjustment should be performed.

THE CORNEA.

he affections of the cornea which require an operation upon the Affections of cornea requiring operation. icture itself are six:—1. Sloughing ulcer. 2. Conical cornea. 3. neal opacity. 4. Staphyloma. 5. Lodgment of foreign bodies. New Growths.

aracentesis, or tapping the cornea.—This operation is sometimes Paracentesis. formed in cases of sloughing ulcer, or suppuration, threatening foration; by the timely evacuation of the contents of the aqueous mber a large rupture of the corneal tissue, with its accompanying s, may in many cases be avoided.

apping the cornea may be done thus:—The patient being in the al position (Fig. 94, p. 396), the operator should stand behind and the lids open by a wire speculum or by the fingers. A broad needle uld then be passed through the cornea at some convenient part of margin; when the point of the needle has fairly entered the erior chamber, its handle should be rotated, so as to bring the idth of the blade across the incision and thus open it; as soon as contents of the anterior chamber have flowed out, the needle

should be withdrawn, a drop of eserine solution placed between the lids, and the eye bound up in the usual manner.

Iridectomy, however, is to be preferred to paracentesis.

Conical cornea.

Conical cornea ("Staphyloma corniæ pellucidum"), as the name implies, signifies an alteration in the curvature of the cornea, of such a nature that it assumes the form of a cone. The origin of the affection cannot clearly be traced.

The most prominent symptom is gradually increasing myopia, which cannot be remedied by concave lenses. On looking at the cornea in profile, its conical form is very evident.

Ophthalmoscopic appearance.

On examination with the ophthalmoscope by the direct method the apex of the cone, which may, however, be the seat of some opacity, appears brightly illuminated; around this bright portion is a dark ring corresponding to the sides of the cone, this being again succeeded by an area giving a bright reflection, and corresponding to a portion of the cornea which retains more or less its natural curvature.

Objects occupying the fundus of the eye are seen through the apex and sides of the cone near its base, in an inverted position, as in myopia, whilst we obtain a more or less distinct erect image of the same parts through the portion of cornea which still retains its normal curvature. The retinal vessels appear to have a whirl-like motion as we change our point of view from side to side. The appearance is quite characteristic, and once seen is not likely to be forgotten.

Treatment.

TREATMENT.—Conical cornea can only be remedied by operative interference; two methods of operating are practised, the object of each being to flatten the cone, and restore to the cornea more or less of its natural curvature.

Removal of apex of cone.

In one operation an elliptical portion including the whole thickness of the cornea is removed from the apex of the cone. The operation can be performed thus (for the position of patient and operator see Fig. 94, p. 396):—An anæsthetic should be given, the lids held open by a wire speculum, and the eyeball fixed by seizing with the toothed forceps the conjunctiva and subconjunctival fascia at some point near the corneal margin. A straight cataract extraction knife (Fig. 166*b*) should then be thrust through the cone from side to side, a small flap formed by cutting out either upwards or downwards, and the flap so made seized with iris forceps and removed with scissors.

In this operation the anterior chamber is opened and the cornea collapses as soon as the first incision is made. Care must be taken that the portion removed includes the most prominent part of the cone, and that the opening left is exactly opposite the pupil.

After the operation the speculum must be very carefully removed, the lids gently closed and bandaged in the usual way; the eye must on no account be examined for a week, so as to give time for the opening in the cornea to fill up. The wound will, in all probability, heal in the course of ten days, the anterior chamber being restored.

Occurrence of anterior synechia.

The margin of the pupil is not unfrequently caught up in the incision, an anterior synechia resulting.

The operation described gives the most satisfactory results, the curvature of the cornea being greatly improved, and a corresponding amount of vision regained.

Removal of portion of thickness of cornea.

In the second operation a superficial portion only is removed from the apex of the cone with a small trephine, a raw surface being left

is subsequent cicatrisation and contraction causes considerable
of the cone.

the cornea is called for in cases of dense white opacity causing disfigurement. The operation can be performed as Tinting.

tion of patient and operator *see* Fig. 94, p. 396. An anæs-
ing been given, the operator should place the wire speculum
he lids, fix the globe with the toothed forceps, paint some
upon the opacity, and prick it thoroughly in with a bunch
fixed in an ivory handle; the ink should be sponged away
to time in order to allow the operator to see what progress
de.

city having been thoroughly tinted, the speculum should be
no bandage need be applied, and no after treatment is
very little irritation follows. If after the lapse of a week Repetition of operation.
ys the opacity do not appear sufficiently blackened, the
may be repeated.

ink be allowed to get into the wound made in the conjunc-
e toothed forceps, a black mark will be left; care should
be taken to fix the globe at a point to which the ink cannot
uld the anterior chamber be opened, the operation must be Perforation of anterior chamber.
ed, as the lens may be wounded.

oma, first so called from its supposed resemblance to a Staphyloma.
s now come to mean a bulge on any part of the eyeball.
ornea it is caused either by yielding of its structure or
monly by prolapse of iris through a perforation in it, the
portion being firmly coated over with inflammatory material.

a is said to be "total" where the whole of the cornea is Total staphyloma.
partial" when some portion of it retains its normal curvature.

hyloma should be removed by abscission (*see* p. 375), or the
ay be excised. Partial staphyloma may subside on the per- Partial staphyloma.
of iridectomy, or can be removed as follows:—The position
, and operator should be as at Fig. 94, p. 396, and an anæs-
uld be administered. The lids being kept open by the wire
a curved needle armed with fine silk should be passed
he base of the staphyloma, an elliptical portion of which
n be removed with a straight cataract knife; the silk should
rawn through and tied, thus bringing the edges of the gap
he removal of the elliptical portion together, and the eye
in the usual way. The suture may be removed in the course
r four days.

bodies.—Small fragments of metal, chips of stone, thorns, Removal of foreign bodies.
t unfrequently found lodged in the cornea. To remove them
n of patient and operator should be as Fig. 93, p. 396. As a
esthetic need be administered. The lids should be kept open
e and ring fingers of one hand, and the globe steadied by
essing upon it with the second finger; the foreign body
n be carefully lifted from its bed with the point of a knife
pud held lightly in the other hand. Foreign bodies, espe-
ns, are sometimes so firmly and deeply embedded that they
be cut out.

New growths. Congenital tumour.
owths may be met with springing from the cornea.
tal tumour is a small white flattened elevation usually situated

ing from the cornea. Such cases usually call for extirpati
eyeball.

THE SCLEROTIC.

Sclerotomy.

Sclerotomy as already stated is one of the operations for
ment of glaucoma. In performing the operation, the p
operator and patient should be as in Fig. 94, p. 396. The in
required are a straight cataract knife (Fig. 103c), speculum,
forceps. The lids should be held open with the speculum, t
fixed with the forceps. The knife should be entered on the
of the globe as far back in the sclerotic as is consistent with
ing the anterior chamber quite at its periphery, pushed a
chamber and brought out at a corresponding point on the i
The transfixion having been finished, the incisions should be
to about double the width of the knife blade which should
withdrawn, its point being carried round the margin of the
chamber so as to notch the parts bounding it, but not cut th
sclerotic. The division of the sclerotic may be made either u
downwards; the points of puncture and counter punctu
situated midway between the horizontal meridian of the corn
upper margin in the former case, midway between its h
meridian and lower margin in the latter.

THE IRIS.

Iridectomy.

Iridectomy is called for in all cases in which it is desirab
fluence the tension or nutrition of the eyeball; it is associat
some operations for cataract; in a somewhat modified form, i
the methods of making an artificial pupil, and is useful in so
conditions.

The operation is performed (1) to influence tension.

To influence tension in sloughing ulcers.

(*a*) *In sloughing ulcers*, or suppuration of the cornea, accom
by pain, and threatening perforation. In such cases iridectom
almost instant relief to the most severe pain, and in all probabil

) *In staphyloma of the cornea* iridectomy often causes complete idence of the projection. In corneal staphyloma.

f) *In glaucoma* a timely and well-performed iridectomy causes ant and lasting diminution of tension and places the eye in com- In glaucoma.

FIG. 100.



Iridectomy Instruments

ent iridectomy knife. *b*. Iris forceps. *c*. Iris scissors.

ative safety; the operation should be performed on any eye that can tinguish *bright* light, and to relieve pain in any case whether there perception of light or not; in acute glaucoma it must be tried even ll perception have been lost for some days.

(2) To influence nutrition, iridectomy should be performed in chronic roido-iritis, recurrent iritis, and in cases of total exclusion of the pil, where there is no communication between the anterior and terior division of the aqueous chamber. To influence nutrition.

(3) Associated with operations for cataract, iridectomy should be formed previous to a needle operation if much swelling of the lens anticipated; or it may require to be done after the needle has been d if pain or increase of tension occur. In cataract operations.

he operation should also be performed at some time previous to, or ultaneously with, small flap or linear extraction of cataract.

Iridectomy for artificial pupil is mentioned at another page.

Other conditions in which iridectomy may be required are— Other conditions requiring iridectomy.

(*a*) Hæmorrhage into the vitreous humour.

(*b*) Displacement of the retina.

(*c*) As an aid to the removal of foreign bodies from the globe.

(*d*) Some peculiar conditions of intra-ocular circulation.

Operation of iridectomy.

Operation of iridectomy.

Instruments required.

Instruments.—A wire speculum (Fig. 97), a straight or bent iridectomy knife (Fig. 100*a*), a pair of toothed forceps (Fig. 99*a*), a pair of iris forceps (Fig. 100*b*), iris scissors (Fig. 100*c*), and a curette (Fig. 103*a*). For the position of patient and Surgeon *see* Fig. 94, p. 396. The patient should be brought fully under the influence of an anæsthetic, the lids kept widely open by the wire speculum; and the eyeball fixed by seizing the conjunctiva and subconjunctival fascia near the corneal margin with the toothed forceps; then, with a straight or bent iridectomy knife of medium size an incision should be made in the sclerotic, in such a position that the knife enters the anterior chamber quite at its peripheral part, and close to the anterior surface of the iris.

The knife, having entered the anterior chamber, should be pushed steadily on (care being taken to keep its point well forwards towards the cornea, so as not to wound the lens), until the point is opposite the centre of the pupil. The point should then be turned to one side, so as to be out of the pupillary area, and the knife slowly and gently withdrawn, the hold of the forceps being let go at the same time. The incision thus made should be of such a length as to correspond to a little more than one-fourth of the circumference of the iris.

Removal of portion of iris.

The next step in the operation is the removal of a portion of the iris. If, as is not unfrequently the case, the iris has become prolapsed, it needs only to be seized with the forceps, and a piece of the desired size removed with the scissors. If the iris does not protrude, the iris forceps should be introduced, shut, through the wound in the sclerotic, and pushed on until the extremities of their branches are opposite the nearest portion of the pupillary margin; they should then be allowed to open of themselves, when the iris will be pushed between the branches by the pressure of the parts behind; no backward pressure must be made with the forceps, but they should be gently closed again and withdrawn, carrying the iris with them, which should then be cut across with the scissors, close to one angle of the wound, drawn over to the other angle, and a piece cut off; the curette should be passed between the lips of the wound so as to push back any portions of iris that may have become entangled in it. The eye should then be bound up with lint and a bandage. The form of the pupil after a well-performed iridectomy should resemble Fig. 102 D.

Introduction of forceps.

Position of portion of iris removed.

With regard to the position of the portion of the iris to be removed opinions are at variance. If the Surgeon be a skilful and experienced operator, and has the aid of a competent assistant, the iridectomy should be done upwards, so as to place the gap beneath the upper lid and thus conceal it as much as possible.

Iridectomy upwards.

To perform iridectomy upwards, a bent iridectomy knife should be used, and the incision made in the sclerotic above the upper margin of the cornea, an assistant should then draw the eyeball downwards with forceps, the iris forceps should be inserted, and the portion of iris removed as previously directed.

Iridectomy downwards and outwards.

An inexperienced operator will find it much easier to remove a portion of iris from its outer and lower segment. In this case a straight iridectomy knife can be used, and no assistant is required.

t is rather an ugly gap; the disadvantage of which, however, unterbalanced by the ease and safety with which the operation rformed.

nts which may happen during the operation of iridectomy, culties which may be encountered.—The accidents which may — Accidents during iridectomy.

ound of the lens from insufficient care in keeping the point nife well forward, and out of the area of the pupil. This will, in all probability, be followed by the formation of c cataract. Wound of lens.

cape of vitreous humour, is very likely to occur in hard eyes, ife be too quickly withdrawn, or if undue pressure be exerted obe with the fixing forceps. Loss of vitreous.

e iris may be torn away from its insertion at a point opposite cision, if undue traction be exercised upon it with the iris Detachment of iris from insertion.

lties.—The iris may be found so rigid that it cannot be th the forceps, or so rotten that only very small portions can ht away; sometimes it bleeds profusely when touched, filling rior chamber with blood, and considerably hindering the . Difficulties.

ial pupil.—The operation for artificial pupil is performed to ew path for rays of light to the retina, the natural passage structed. Artificial pupil.

dicated in the following cases:—(1) In opacity of the cornea, vithout anterior synechiæ. (2) In closure of the pupil. (3) ive posterior synechiæ. (4) In central opacity of the lens or le.

rtificial pupil must be small, as nearly central and as well as possible. Care must be taken to make it behind that f the cornea which is most transparent and least altered in e, the best situation being ascertained by oblique illumination. pupil must not be made upwards, or it will be covered by the . Position of new pupil.

ificial pupil can be made in any of the following ways:—(1) ion of the iris. (2) By tearing it away from its insertion. xcision of a portion (iridectomy for artificial pupil). (4) By Methods of making artificial pupil.

rations for artificial pupil the position of patient and Surgeon e the same as in "iridectomy," and an anæsthetic should be ered.

Incision (Fig. 102 A).—This operation is called for in cases of closure of the pupil, following removal of the lens, either by or injury, but is not advisable unless the lens be absent. In es the iris may be found changed into a tense, unyielding e, which cannot be seized with forceps. Incision.

eration of "incision" may be performed either by thrusting a edle through the cornea near its margin, and then incising the s to cut across its radial fibres; or an incision having been th an iridectomy knife in the sclero-corneal margin, a pair rs (having one sharp and one blunt-pointed blade) may be d through the wound, one blade being thrust through the iris arest point and passed behind it, the other carried along its

anterior surface, and the iris then cut fairly across from one side to the other.

Whichever plan of incision is adopted, the vitreous humour pushes forward into the wound and keeps its edges widely separated, a pupil resembling Fig. 102 A being formed.

Iridotomy.

Two other methods of making an artificial pupil by "incision" have been lately introduced; they are known as single and double "iridotomy."

For the positions of patient and Surgeon in performing either of these operations, *see* Fig. 94, p. 396.

(*b*) *Single iridotomy* should be thus performed:—The eyelids being kept open with the wire speculum, and the eyeball fixed by seizing the conjunctiva and subconjunctival fascia, close to the margin of the cornea at its inner side, an incision should be made with an iridectomy knife in the cornea, about midway between its margin and the pupil, and opposite to the point of fixation with the forceps. The forceps scissors (Wecker's, Fig. 101) must be then introduced closed through the wound into the anterior chamber, the blades opened, one passed through the pupil behind the iris, the other on its anterior surface, and the sphincter of the pupil be divided with one sharp cut. The scissors

Wecker's scissors.

FIG. 101.



Wecker's scissors.

should then be withdrawn, any prolapse of iris that follows replaced with the curette, a drop of atropine placed between the lids, and the eye lightly bandaged.

This operation is applicable to cases where the lens is present, its centre being opaque and its peripheral portion clear.

Double iridotomy.

(*c*) *Double iridotomy* is applicable to cases of closed pupil after cataract extraction. An incision should be made through the upper part of the cornea, the knife carried through the iris and along its posterior surface, so as to make a fair-sized wound in it; the incision being finished the knife should be carefully withdrawn, and, very possibly, some vitreous humour will follow it.

Escape of vitreous.

FIG. 102.



A. Pupil after incision. B. Pupil after excision. C. Pupil after ligature. D. Iridectomy for glaucoma, &c.

The next step in the operation is to pass the forceps scissors, closed, through the wound in the cornea into the anterior chamber, open them, pass one blade behind the iris, the other in front of it, make an

incision in a direction downwards and inwards; then change the direction of the scissor blades and make a cut downwards and outwards. Thus a small piece of iris is enclosed by a V-shaped incision, the apex of the V being upwards. The small portion of iris contracts up, and a somewhat triangular pupil is left. The eye should be bound up as usual.

Iridodyalisis.

(2) **Tearing away the iris from its insertion (Iridodyalisis).**—An incision having been made through the cornea on the side opposite to that on which the iris is to be removed, a pair of iris forceps should be passed through the wound and across the anterior chamber, the iris seized close to its greater circumference, and torn forcibly away from its insertion; the instrument should then be carefully withdrawn and the eye bound up. If necessary, the whole iris may be removed in this way. This operation is applicable to cases of dense corneal opacity (leucoma), occupying the whole of its central part, some transparent cornea being left at the margin.

Iridectomy for artificial pupil.

(3) **Excision—Iridectomy for artificial pupil.**—An incision should be made of the requisite size, through some part of the sclero-corneal margin, the iris forceps introduced through the wound, the ends of their branches passed fairly up to the margin of the pupil, the iris seized and drawn out through the wound, and a small portion removed with scissors. The curette should then be passed between the lips of the wound so as to push back any portion of iris that may have become entangled in it; a pupil resembling Fig. 102 B should be formed.

Iridesis.

(4) **By ligature (Iridodesis, or Iridesis).**—An incision should be made with a broad needle near the margin of the cornea, a small noose of silk laid upon the surface of the eyeball so as to encircle the incision; an iris hook or canular forceps then passed through the noose and wound, and the iris drawn gently out; an assistant with two pairs of broad-ended forceps should seize each end of the nooze and firmly ligature the included portion of iris; the ligature will drop off in the course of a few days, a pupil resembling in shape Fig. 102 C being left.

THE CRYSTALLINE LENS.

Cataract.

By cataract we understand an opacity of the crystalline lens.

Causes of cataract.

The causes of this opacity are somewhat obscure, but it probably depends on impairment of nutrition of the lens consequent on senile decay or constitutional conditions (*e.g.* diabetes).

It also occurs in connection with inflammatory changes in adjacent parts—the choroid, ciliary body, vitreous, and iris; is met with as a congenital defect—and very frequently results from injury.

Forms of Cataract.

Forms of cataract.

There are two principal forms of cataract:

(1) *The cortical or soft cataract.*

(2) *The nuclear or hard cataract.*

In the first form the cortical substance of the lens is primarily affected, the nucleus afterwards becoming opaque, the whole being soft, or even fluid.

In the second the nucleus of the lens first becomes hard and opaque, the cortical substance being subsequently affect

Cortical cataract.

The cortical cataract is met with as an idiopathic disease i and early adult life, and as the result of injury at all ages.

There are several varieties of cataract.

Zonular cataract.

(*a*) *Zonular or lamellar cataract* is either congenital or soon after birth; it is characterised by an opacity of circula well-defined outline, situated in the cortical substance of th at some distance from its surface; the margin, nucleus, and layers of the lens are transparent.

(*b*) *Ordinary congenital cataract* is a bluish-white opa whole lens.

Traumatic cataract.

(*c*) *Traumatic cataract* is an opacity of the lens often a by swelling, and caused by rupture of its capsule from i the subsequent action of the aqueous humour upon its subst

Posterior polar cataract.

(*d*) *Posterior polar cataract*, an opacity situated at th pole of the lens; and—

Diffluent cataract.

(*e*) *Entirely fluid or diffluent cataract* is caused by chan lens, secondary to inflammation of adjacent parts.

The variety of cataract met with in diabetes is composed of soft material; but if the patient be advanced in yea usually a hard nucleus.

Nuclear cataract.

Nuclear cataract occurs in persons who have passed t period of life, and is characterised by the presence of a har central portion or nucleus of varying size and density; the surrounded by more or less soft cortical substance, and is o

Black cataract.

of a greenish, or almost black colour, giving rise to what is *green or black cataract*.

Diagnosis of cataract.

Diagnosis of cataract.—The existence of cataract is e tained by oblique illumination, the pupil having been di atropine previous to making the examination.

Treatment.

TREATMENT.—The treatment of cataract is entirely op kind of medication being of the least use.

Our object in performing an operation is to open a path f light to pass to the retina. This can be attained in one of the method adopted depending on the kind of opacity prese

(1) In cases (as lamellar cataract) where the bulk of t clear, the opacity being situated in the axis of the nor very useful vision is procured by making an artificial pup a transparent portion of the lens (*see* Artificial Pupil).

(2) When the whole lens is opaque, its entire remova accomplished.

Varieties of operation.

Three varieties of operation are performed to secure th of the whole lens:

(1) The operation for solution or absorption.
(2) Extraction.
(3) Suction.

Forms of cataract to which each is applicable.

Forms of cataract to which each operation is applicable.— rule, cataract occurring in persons below twenty is of th cortical form, and should be removed by *solution* or *suction* occurring in persons above thirty (except traumatic cata the hard or nuclear form, and must be removed by extractio

In the intermediate decade a doubt may arise as to what i

plan of procedure; in these cases the Surgeon must be guided by the general appearance of the cataract; if it appears bluish in colour, and somewhat swollen, it is probably soft and can be removed by *solution* or *suction*; if there is a distinct yellow reflection from its centre, denoting the presence of a hard nucleus, it should be removed by *extraction*. It must also be borne in mind that loss of time is a very serious consideration with most patients, consequently a preference must always be given to that operation which will allow him to resume his occupation as early as possible.

Solution, though perhaps somewhat safer than extraction, is always a tedious process, and the more so the older the patient; consequently, preference must be given to extraction in all cases where the condition of the patient's sight is such as to prevent him following his occupation, even though there be no appearance of a hard nucleus. In cases where the cataract is evidently soft, and one eye retains useful vision, solution is to be preferred to extraction, as the patient can continue at his work during the time that absorption is going on.

Before performing any operation for cataract we must take care to ascertain that the eye has good perception to light, indicating that the retina is in a normal condition; otherwise no improvement in vision will result from removal of the lens.

Operations for Removal of Cataract.

Solution.

Solution.—In the operation for solution the capsule of the lens is opened, and its substance thus allowed to be acted upon by the aqueous humour, by which it is broken up and softened, absorption finally taking place.

The operation can be performed as follows (for the positions of patient and operator *see* Fig. 94, p. 396):—No anæsthetic is needed; the pupil should be well dilated with atropine; the operator keeping the eyelids separated by the fore and ring fingers of one hand, and steadying the globe by pressing the second finger gently upon it, should take a cataract needle in the other hand and pass it obliquely through the cornea at such a distance from its centre that any resulting cicatrix will not interfere with vision; the needle should then be pushed on across the anterior chamber into the area of the pupil; its point then depressed and three or four incisions made with it in the lens-capsule, so as to divide it freely. Care must be taken to use the needle very gently, and not to pass it too deeply into the lens, otherwise the suspensory ligament may be torn and the lens displaced.

Precautions to be taken.

The capsule having been freely divided, the needle should be carefully withdrawn and a drop of solution of atropine placed between the lids; the only after-treatment required is the constant use of atropine, so as to keep the pupil widely dilated.

If the eye be examined in the course of a few days white flocculent lens matter will be seen protruding through the opening in the capsule into the anterior chamber, showing that the lens is swelling and undergoing solution.

The operation will probably require to be repeated in about a month or six weeks, and possibly on one or two subsequent occasions, before the whole lens is absorbed. Care must be taken not to do too much at one sitting, or the lens may swell too rapidly and press upon the

Operation requires to be repeated.

surrounding parts, giving rise to severe pain, increased tension the globe, iritis, cyclitis, &c.

Extraction of cataract.

Extraction of cataract.

The object of operations for extraction of cataract is the remova the lens through an incision altogether in the cornea, the sclero-cor margin, partly in the sclerotic and partly in the sclero-corneal mar or wholly in the sclerotic; the incision being either simple or associ with excision of a portion of iris.

Extraction can be best performed by one of the five follow methods:—(1) Flap extraction, (2) small flap with iridectomy, extraction by oblique corneal section, (4) linear extraction, (5) ext tion by means of a traction instrument. In the first and third meth no iris is removed; in the second, fourth, and last, iridectomy sho be performed either at the time of removal of the lens or some we or months previously. All entirely opaque lenses (mature cataract may be removed by the first or third methods; all partially opa lenses (immature cataracts) must be extracted by the second or four a traction instrument being used in any case where great difficulty encountered, or where escape of vitreous has taken place before t lens has been extracted.

FIG. 103.

Extraction instruments.



Instruments for extraction of cataract.
a. Curette and pricker. *b*. Triangular cataract knife. *c*. Straight cataract knife (Graefe's). *d*. Sharp hook. *e*. Scoop.

We shall, however, find that in all cases we obtain most uniform success by extraction associated with iridectomy; we should never attempt to extract an immature cataract without first excising a portion of iris, and it is well to do so as a preliminary some weeks before the lens is removed.

Flap extraction.

Flap extraction.

The instruments required for flap extraction are a triangular cataract knife, sharp hook, and curette (Fig. 103 *b*, *d*, *a*).

For the positions of patient and operator *see* Fig. 94, p. 396. No anæsthetic is required; the patient should be requested to look downwards, the lids kept open and the eyeball steadied by the operator's fingers as in the operation for solution.

The incision should be made by passing a triangular cataract knife through the outer margin of the cornea, at a point just above its horizontal meridian, into and across the anterior chamber, bringing it out through the cornea at a corresponding point on the inner side, and completing the section by pushing the knife onwards until its heel cuts out along the upper margin of the cornea. (Fig. 104 A). Method of making section.

Fig. 104.



Incisions for extraction.

Incisions for extraction of cataract.
A. Flap. B. Oblique corneal section. C. Lineal incision.

This simple onward movement of the knife is sufficient if the incision has been properly planned, but should the cornea have been entered too low down, the knife will not be wide enough to cut out, and then the section must be completed by slightly withdrawing the blade or by a sawing movement. Care must be taken not to withdraw the knife until it has passed some distance through the opposite side of the cornea, or the aqueous humour will escape too soon, and the iris fold over the edge of the knife and be wounded.

If the incision has been properly made it will lie within the corneal margin and a semicircular flap, including a little less than half the cornea, will be formed.

The section having been finished, the patient should close the eyes gently, and be allowed to rest for a moment.

The next step in the operation is the removal of the opaque lens. The upper lid being drawn gently upwards and the patient directed to look downwards, the sharp hook must be introduced through the wound and the lens capsule lacerated by gently scratching it; the hook should then be withdrawn, and the patient allowed to close the eyes for a short time. Removal of the cataract.

The eyes should then be gently opened, and the lens removed by slightly pressing the lower lid against the globe, just below the inferior margin of the cornea, with the thumb of one hand, counter-pressure being similarly applied with the forefinger of the other hand at a corresponding point above. If the manœuvre be properly executed the pupil gradually dilates, the lens slips gently through it into the anterior chamber and then escapes by the corneal wound. Any prolapse of iris that may occur must be carefully returned with the spatula; each eye should then be covered with two pieces of wet lint and a light bandage applied.

Small flap with iridectomy. Small flap.

A flap section should be made by transfixing the eyeball through the

operation, when the section is made downwards; Bowman's by small median flap," when the section is made upwards to me that the term "oblique corneal section" expres dispenses with much unnecessary prolixity.

The instruments required are a thin straight cataract kn hook and curette (Fig. 103 *c*, *d*, *a*). (For the position of Surgeon *see* Fig. 94, p. 396). No anæsthetic is required, a exception of the incision, the steps of the operation are mu as in flap extraction.

Method of making incision.

The incision may be made either upwards or downwards by passing the straight knife through the sclero-corneal the outer side at a point (puncture) corresponding to th corneal meridian into and across the anterior chambe corresponding point on the inner side (counter-puncture cutting forwards by a sawing movement, *obliquely*, t cornea, midway between the pupil and upper or lower corn the former if the incision is made upwards, the latter if downwards. In entering the knife and passing it across chamber, care must be taken to keep its edge directe towards that part of the cornea which it is desired to in knife be rotated in any way after the anterior chambe opened, the aqueous humour will escape and the blade becom in the iris.

The capsule should be lacerated and the lens removed way as in flap extraction; the position of the incisi centre of the cornea, however, will not allow the lens to be immediately, as is done in the flap operation.

Removal of the cataract.

Before attempting to squeeze out the cataract its mar brought opposite the incision by gently pressing upon above or below, according as the section has been made downwards.

Treatment of soft matter.

The bulk of the cataract having been removed, care mu to get away any soft cortical substance or fragments of le be left. The soft matter can be removed by gently

partly in the sclerotic and partly in the cornea, or altogether in the former; usually associated with iridectomy, performed at the time of extraction of the cataract, or some months previously.

By linear incision is generally understood an incision made in the same direction as a straight line drawn from the centre of curvature of the cornea to its circumference (one of its radii). Many modifications of linear incision are practised, but only one will be described here. The instruments required for linear extraction are a wire speculum (Fig. 97), toothed forceps (Fig. 99*a*), a straight cataract knife, a curette, sharp hook (Fig. 103 *c*, *a*, *d*), iris scissors, and iris forceps (Fig. 100 *b*, *c*). Instruments required.

The operation should be performed thus, and, as in the other forms of extraction, the incision may be made either upwards or downwards (for position of patient and operator *see* Fig. 94, p. 396):—The patient should be thoroughly anæsthetised, the lids kept open by a wire speculum, and, supposing the incision to be made upwards, the globe must be drawn gently downwards with the toothed forceps, holding the conjunctiva and subconjunctival fascia close to the lower margin of the cornea; then with the straight cataract knife puncture and counter-puncture should be made in the *sclerotic*, just beyond the sclero-corneal margin, the knife entering at a point on the outer side of the globe, situated about two-thirds of the way between the horizontal meridian of the cornea and its upper margin, and emerging at a corresponding point on the inner side; the edge of the knife should then be directed nearly straight forwards, and by a sawing movement made to cut its way out through the cornea, at a short distance from its upper margin. (Fig. 104 C). Employment of anæsthetic. Method of making incision.

If iridectomy has not been previously performed, a piece of the iris should next be excised from the upper segment (*see* Iridectomy).

The next step is to lacerate the capsule. The operator should fix the eye, and draw it gently downwards with the toothed forceps, then introduce the sharp hook through the incision and freely lacerate the capsule with it. The cataract can then be removed by making gentle pressure with the curette upon the eyeball, near the lower margin of the cornea, the globe being steadied and held in position by fixing the conjunctiva with the toothed forceps. Laceration of capsule.

The nucleus and bulk of the cataract having escaped, the curette should be passed gently over the surface of the cornea from all directions towards the incision, so as to press out any cortical substance that may be left, and if any blood or portions of lens remain in the incision they must be carefully removed, so as to insure perfect coaptation of its margins; the speculum should then be removed, and both eyes bandaged in the usual way. Removal of soft matter, &c.

The incision for linear extraction, as already stated, may be made downwards as well as upwards, the former method of operating being much the easier, and not requiring the aid of an assistant.

The same objections apply to extraction downwards as to iridectomy in the same direction, but the results obtained are equally good as from upward sections and the ease with which the operation can be performed quite counter-balances any objections which may be made on the score of disfigurement.

Extraction of cataract by a traction instrument. Extraction by traction.

Cataract can be removed by a traction instrument, either through a

flap section or a linear incision peripherally situated, iridectomy being performed in either case.

The patient should be thoroughly anæsthetised, and, whichever incision is made, the eyelids should be kept open with the speculum, and the globe fixed with the toothed forceps, while the section is made and during the subsequent removal of the lens.

The traction instrument employed is either a scoop or a sharp hook (Fig. 103 *e*, *d*).

Removal of cataract by the scoop (scoop extraction).

Scoop extraction.

Scoop extraction can be accomplished thus:—The section having been made and iridectomy performed, the convex surface of the scoop should

Fig. 105.



a
Needle for making incision in suction operation.

Suction tube.

be pressed gently upon the more peripheral margin of the incision, so as to cause it to gape somewhat; the instrument should then be passed with the utmost gentleness through the incision, beneath the margin of the lens, along its posterior surface and beyond its posterior pole, until the lens lies well in its concavity, and it should then be carefully withdrawn, carrying the cataract with it, the removal being assisted by gentle pressure on the exterior of the globe.

Sharp-hook extraction.

Removal of cataract with the sharp hook (sharp-hook extraction).

The hook should be passed well behind the lens in the same manner as the scoop, fixed into its posterior surface, and then carefully with-

rrying the lens with it. Two sharp hooks may be used in-
ne, and should be fixed into the lens at different points, so as
it rolling round (as sometimes happens when only one hook
nstead of passing in the desired direction.
emoval of the lens by either method both eyes should be
in the usual way.

.—The removal of cataract by suction is indicated in cases Suction.
lens has become nearly or entirely fluid, as occurs in many
of traumatic cataract, and frequently after a needle operation
performed.

struments required are a wire speculum, toothed forceps, Instruments required.
dle, and suction tube (Figs. 97, 99*a*, 105 *a*, *b*). Before
the pupil should be well dilated with atropine. (For
f patient and Surgeon *see* Fig. 94, p. 396).
est, but not absolutely necessary, to place the patient under
nce of an anæsthetic. The lids should be kept open by a wire
the eyeball fixed by the toothed forceps, and a small linear
nade in the cornea with the broad needle, about midway
ts summit and margin, in any convenient position.
rator should then place the mouth-piece of the suction tube Method of using suction tube.
outh, pass its nozzle through the incision and behind the
lens, and, by sucking gently, remove as much lens matter as
away easily. No force must be used, and if any portion of
be too hard to pass easily into the tube it may be left to
bsorbed or be dealt with on a future occasion. When as
s as will easily come away has been extracted the suction
ld be removed, the speculum taken out, a drop of solution of
placed between the lids, and the eyes bandaged in the usual
e bandage should be continued, and the pupil kept dilated
pine, until all irritation has subsided.

Accidents during Extraction of Cataract.

Accidents which may happen.

ure escape of aqueous humour.

be not taken in making the section the aqueous humour may
o soon, and the movements of the knife be hampered by the
g forwards. Should this happen, the knife must be carefully
n and the section completed with scissors.

g into the anterior chamber. Bleeding into anterior chamber.

e cases hæmorrhage from the cut iris or conjunctiva takes
uch an extent as to fill the anterior chamber with blood and
ataract entirely from view.
blood does not flow out easily on placing the curette between
f the incision and making gentle pressure on the cornea the
should be discontinued, the eye bound up, and left till the
become absorbed, unless the lens-capsule has been lacerated,
case the lens *must be removed at all risks*, or it may swell,
on surrounding parts, set up inflammatory action, cause
f tension of the globe, and very probably lead to destruction
.

e of vitreous humour. Prolapse of vitreous.

undue pressure be exerted on the globe during extraction the
y ligament of the lens gives way and a prolapse of vitreous
Should the prolapse of vitreous occur before the escape of the

lens the cataract should be removed as quickly and gently as possible by the aid of a scoop or sharp hook.

Prolapse of vitreous is more likely to occur if the humour is abnormally fluid. The accident may give rise to no bad results, but is sometimes followed by a form of chronic choroiditis which ultimately destroys the eye.

If vitreous has been lost great care must be taken to bandage the eye so as to keep the lids immovable and prevent them pressing upon the globe and causing further prolapse.

Displacement of the cataract.

Displacement of the cataract.

In some cases, on an attempt being made to press out the lens, the suspensory ligament gives way, and the cataract, instead of coming forwards into the anterior chamber passes behind the iris or sinks backwards into the vitreous chamber; it should, if possible, be removed by the scoop or sharp hook. If left within the globe it will probably act as a foreign body, set up inflammation, and destroy the eye.

After-treatment of Extraction of Cataract.

After-treatment.

Immediately after the operation each eye should be covered with two folds of wet lint secured by a bandage, which has been contrived for the purpose by the late Mr. Dunnagel, of the Central London Ophthalmic Hospital. The patient should then be put to bed, where he should remain for three or four days.

The lint must be kept constantly wet for the first week, and fresh pieces should be applied every two or three days.

Condition of eyelids.

On no account should the eye be examined until the end of the first week; if the lids remain in a normal condition we may rest assured that all is going on well, and opening the eye too early can do no good, and may do a great deal of harm.

At the end of a week the eye may be opened and its condition ascertained. Should the section be healed, the anterior chamber re-established, and no signs of inflammatory action present, the sound eye can be safely left uncovered, the one that has been operated on being kept bandaged with dry lint, and a large green shade worn over both.

Bandage may be removed.

At the end of three weeks the bandage may be removed from the eye on which extraction has been performed, but the shade or protector should be worn until all undue vascularity has subsided.

Glasses may be ordered.

At the end of about two months (if there be no intolerance of light or irritability of the eye) glasses should be ordered, two pairs being given; one for going about, and one for reading; convex 13 D will usually be found most suitable for the former purpose, convex 16 D for the latter. But should the patient have been myopic or hypermetropic before the operation, glasses weaker or stronger than these may be required.

This is the usual course of cases of extraction of cataract; all do not, however, go on so favorably.

A day or two days after the operation the patient may complain of severe pain in the eyeball, temple, and brow, and on removing the bandage the lids may be found puffy and red, or perhaps much swollen

[1] Dunnage's bandage consists of a piece of material of an open texture—through which water will easily run—of such a length as to cover both eyes, and leave some to spare. To each end of this piece are attached tapes by which the bandage is secured.

These symptoms always indicate inflammatory changes in some of ocular structures; the inflammation may be simply an attack of is, which will probably proceed to a favorable termination; but may sequently affect the choroid, a chronic form of choroido-iritis being up, which leads to softening, and eventually to shrinking of the be; the cornea may be inflamed or suppurating, or inflammation l suppuration of all the ocular structures (panophthalmitis) may have in. For the treatment of these cases *see* Iritis, Corneitis, &c. Symptoms of inflammation.

A not uncommon cause of pain and irritation is the occurrence of ropion of the lower lids; this must be remedied by operation (*see* erations on the Eyelids). Occurrence of entropion.

Causes of Unsatisfactory Results of Cataract Extraction.

The result of an operation for extraction of cataract may be marred closure of the pupil consequent on iritis, by obstruction of its area h opaque lens capsule, or by opacity of the vitreous humour. Closure of pupil.

Occlusion of the pupil should be remedied by making an artificial (*see* Artificial Pupil); capsular obstructions should be torn through h cataract needles, cut across with scissors, or removed bodily with ceps. Capsular obstruction.

The greatest caution must always be exercised in meddling with ique capsule, as an operation upon it, especially an attempt to tear forcibly away, is very likely to be followed by increase of tension, ammation, or even suppuration of the eyeball.

For opacity of the vitreous humour nothing can be done. Opacity of vitreous.

EXTIRPATION OF THE EYEBALL. Extirpation of eyeball.

Removal of the eyeball is called for under the following conditions: Cases in which the operation is called for.

1) In all cases of injury causing complete disorganisation, with lapse of the globe and escape of its contents.

2) In cases where one eye, having been damaged by injury or dis-e to such an extent as to render it *practically useless*, becomes itable or painful, and the sound eye appears threatened by sympa-tic ophthalmia.

3) In cases where an eye lost from injury or disease, and *quite ed*, is a source of annoyance, even though the other eye be not eatened.

4) In cases where the globe has become the seat of malignant ease.

Extirpation of the eyeball should be thus performed (for position of ient and operator *see* Fig. 94, p. 396):—The instruments required Operation of extirpation.
a wire speculum, toothed forceps, a pair of blunt-pointed scissors, ved on the flat (Fig. 106) and a strabismus hook. The patient being roughly under the influence of an anæsthetic, the operator should ce the wire speculum between the lids, then by the aid of the for- Division of the conjunctiva.
s and scissors cut through the conjunctiva all round the cornea close to its margin as possible; he should then, with the stra-mus hook, take up the four recti muscles, one after the other, and Division of the muscles.
ide them with the scissors, either the external or internal rectus ng cut at a little distance from the globe, so as to afford a hold for forceps in the subsequent steps of the operation, and the other three scles as close to it as possible.

The muscles having been divided, the hook should be m round the globe, so as to be sure that nothing is lef pressing the speculum backwards the eyeball will become

Fig. 106.

Extirpation scissors.



Extirpation scissors.

front of the lids, and then being steadied by holding the pi purposely left, with the forceps, the scissors should be pas until their points are found to be in contact with the opti slightly withdrawn, opened widely, pressed forwards again, divided by a single cut.

Division of optic nerve.

As soon as the nerve has been cut through, the eye almost free, being held only by the oblique muscles, whi divided close to the sclerotic. Should there be free hæ speculum may be left between the lids, a piece of sponge p into the orbit, and secured by a turn of bandage; when has ceased the sponge should be removed with the specul small pads of wet lint and a bandage applied. Should the be but slight two or three small pads of wet lint must be closed lids, and secured by a bandage in the same manne

Artificial eye.

operations on the eye. In about a month or six weeks an may be ordered.

Abscission.

ABSCISSION.

Abscission is the removal of that portion of the eyeba the ciliary region) situated in front of the attachments muscles, these being left intact. The object of this op leave a movable stump, on which an artificial eye can rest a in harmony with the movements of the sound one.

Cases to which it is applicable.

Abscission is indicated in staphyloma occupying the who part of the former situation of the cornea, the remainder retaining its normal curvature.

The operation.

The operation should be thus performed (for position of operator *see* Fig. 94, p. 396) :—The instruments required speculum, toothed forceps, strabismus scissors, a triangul knife, a curved needle and silk. The patient being thoro the influence of an anæsthetic, the wire speculum should b tween the lids, the conjunctiva divided all round close to margin (as for extirpation), and dissected back to the desire

Then with the curved needle a single suture should be pas the edge of the divided conjunctiva at five or six different p

ound the wound in it in much the same manner as the string
ds the mouth of an ordinary bag, and the ends of the silk left
g on the patient's face.

staphyloma, the whole of the ciliary body, and sclerotic corre-
ng to it, should then be removed by transfixing the globe with
ngular knife just in front of the insertions of the internal and
l recti muscles, cutting out upwards in front of the insertion of
erior rectus, and finishing the removal by a sweep of the knife
opposite direction.

silk should be then drawn up and tied, by which means the
ctiva will be made to cover the wound in the globe, and wet lint
bandage applied. As soon as the parts have firmly healed an
al eye may be worn.

ission should be performed in preference to excision of the globe
dren; the presence of the stump left prevents to a great extent
inking, or non-development, of the orbit which will occur if the
l be removed entirely.

lder persons excision is generally to be preferred, as the stump
ter abscission is very liable to become troublesome, and in the
id is prone to suppurate.

AFFECTIONS OF THE ORBIT.

rusion of the eyeball.—As many of the diseases of the orbit and nsiderable extent tumours of the eyeball itself, cause more or less sion of the globe, it will be well to say a few words on this subject describing the morbid changes which may give rise to it. Protrusion the eyeball.

symptoms are obvious enough, and do not require description. Causes.
uses are the following:

flammation within the orbit, either with or without the forma-
abscess.

emorrhage into the orbit.

scular protrusion of the eyeball.

ophthalmic goitre.

nours within the orbit, nodes, exostoses, malignant growths,
vi, &c.

rgement of the eyeball itself from (*a*) growths, malignant
; (*b*) inflammation and suppuration of the whole eyeball
itis).

lysis of its muscles, allowing the globe to drop forwards, and
e an unusual prominence.

ision is *generally* complained of in protrusion of the eyeball. Ill effects o protrusion.
ects of the abnormal position are seen both in the globe
n the lids. Should the protrusion be so great that the lids
osed over the eyeball the cornea will be left unprotected
come opaque, and afterwards ulcerate or slough. If the
ntinue for long the lids become distended and flaccid, their
eing much impaired; the tear puncta may also become
ing rise to continual watering of the eye.

.—In all cases where the eyeball is healthy care should
otect the cornea from injurious exposure, by drawing the Closure of lids.
d keeping them fixed by a compress and bandage, but
s the edges of the outer third of the lids must be pared,
es, and allowed to heal firmly together.

Inflammation within the orbit.

Inflammation within the orbit.

Inflammation may affect the soft tissues within the orbit, the periosteum, or the bone itself; it may end in resolution, the parts returning to their natural condition; chronic thickening may result, causing more or less permanent protrusion and impairment of the movements of the eyeball; or abscess may form, and in the case of periostitis or ostitis caries and necrosis of the bony walls may supervene.

Symptoms.

Symptoms.—Inflammation within the orbit is accompanied by more or less febrile disturbance, pain of a throbbing character much increased by pressure, swelling of the conjunctiva and lids, more or less prominence and impaired movement of the eyeball, intolerance of light, and watering of the eye; it may be the result of cold, injuries, or general diseases, as erysipelas, and (in the case of periostitis) of syphilis, or may come on in debilitated states of the system, during recovery from acute diseases (scarlet fever, measles, &c.), or from over-lactation. It is not easy to distinguish inflammation affecting the soft parts only from inflammation of the periosteum or bone.

Causes.

Treatment.

Treatment should consist in allaying pain and inflammation by means of opium internally, fomentations of poppy-heads to the affected part, leeches to the corresponding temple (two to six in number), and rest in bed in a darkened room; any general medical treatment which may appear most applicable should also be employed.

For instance, if the patient be strong and healthy, low diet, purgatives, &c., should be had recourse to; if weakly, as during recovery from some acute disease, tonics and good diet should be prescribed. Should the patient be the subject of syphilis this should be treated.

Abscess.

Should the inflammation go on to the formation of abscess, the symptoms are aggravated, the conjunctiva becomes more swollen, and in some cases almost covers the cornea, the lids are greatly swollen and red, the prominence and impairment of movement of the eyeball increase, and rigors may occur. Vision becomes misty, and in some cases all perception of light is entirely lost. After a time fluctuation may be detected; if left to itself, the abscess will burst, the pus being discharged either through the skin or conjunctiva. The abscess having been emptied, in favorable cases the swelling will disappear, the eyeball resume its natural position, and the opening heal. But in some cases, especially if the suppuration be associated with caries and necrosis of the bone, the abscess will remain open, or the orifice alone heal, the sac again becoming filled with pus.

Treatment.

Treatment.—As soon as the surgeon feels satisfied of the existence of pus in the orbit it should be evacuated; if fluctuation can be detected the diagnosis is easy enough, but even if this cannot be done, and suppuration is suspected, an exploratory puncture should be made, when the escape of pus will clear up any doubt.

The best method of opening an abscess in the orbit is that recommended by Mr. Hilton for evacuating pus situated at a depth from the surface amongst important structures. The operation should be performed as follows:—An incision having been made, either through the skin or conjunctiva, at that part where the eyeball appears to be thrust away from the wall of the orbit, a grooved director should be thrust in (the surgeon bearing in mind the direction of the [illegible] along which he is passing the instrument and the depth of the [illegible]). As soon as pus is seen escaping along the groove of the direc[illegible]

Hilton's method of opening abscess.

pair of small dressing forceps should be passed along it until their points are within the abscess; the blades should then be separated slightly and drawn out whilst so separated; a ragged opening will thus be left, which is not likely to close too soon, and the danger of cutting important structures will be obviated.

The greatest care must always be taken not to injure the eyeball. As the operation is very painful, an anæsthetic should be given.

Immediately after the operation search should be made by means of a probe for diseased bone or foreign bodies; if a foreign body or loose sequestrum be detected it should be at once removed; diseased bone, if still firm, may be left to itself, and will either come away spontaneously or may require removal at a later period. If the opening appear inclined to close too soon it should be kept open by means of a piece of lint passed into it; only light water dressings need be applied.

Periostitis or ostitis followed by caries and necrosis of the walls of the orbit. Periostitis or ostitis.

Symptoms. Symptoms.—The symptoms of periostitis or ostitis going on to caries or necrosis are similar to those above described, excepting, perhaps, that the pain is more severe and often aggravated at night. This form of inflammation should always be suspected in persons suffering from syphilis, and occasionally nodes may be met with at the margin of the orbit or on the forehead; their existence should always lead the Surgeon to suspect that the inflammation within the orbit is periosteal. When the abscesses has formed and burst, or has been opened, the seat of inflammation becomes evident from the character of the pus, which is of that peculiar unhealthy and bad-smelling variety met with in abscesses connected with diseased bone, as well as from the condition of the opening, which remains patent and is surrounded by large unhealthy granulations, and from the fact that the bare bone can be felt with a probe passed through the opening.

Terminations. Caries and necrosis usually end in recovery after a time, the diseased bone being thrown off and the sinus becoming closed. The disease generally attacks the margin of the orbit and often leaves cicatrices, which cause great disfigurement and deformity of the eyelid. Should caries or necrosis occur deeply in the orbit the results may be most serious, the optic nerve becoming affected and vision lost, or the disease may spread to the interior of the skull, set up meningitis, and cause death.

Treatment. Treatment.—In the earlier stages the treatment should be the same as that described under inflammation and abscess of the orbit, but when the abscess has burst, or been opened, its cavity should be syringed out daily with some mild disinfecting solution; care must be taken to prevent its too early closure, by means of a piece of lint pushed into the sinus; exuberant granulations should be kept down by the application of nitrate of silver, and distortion of the lids, if likely to occur, must be prevented by uniting their edges (*see* Operations on the eyelids.

Removal of dead bone. If any pieces of bone are found loose they should be removed by operation.

Hæmorrhage into the orbit.

Orbital hæmorrhage. Spontaneous. Orbital hæmorrhage may depend upon the spontaneous rupture of a vessel within the orbit and, should it be considerable, may produce displacement of the eyeball. The blood may become diffused, and appear

bandage. Where excessive hæmorrhage occurs after
strabismus a large pad of lint should be placed on th
and firm pressure by means of a bandage kept up for
after the operation. Hæmorrhage from fracture of th
is only of secondary importance to the injury which
may be left to itself; it is of more interest to the ge
than the specialist.

Vascular protrusion.

Vascular protrusion of the eyeball.

This is the name applied, and very justly, by Mr. Thor
('Medico-Chir. Trans.,' vol. xlviii) to a set of cases forme
to belong to the class of "aneurism by anastomosis," b
Nunneley shows differ in many essentials from the la
both in their clinical aspect and history. He has also had
of verifying his diagnosis by post-mortem examinatio
case has he met with an instance of the above-mentioned
to this cause. Mr. Nunneley has reported in all sev
mentions some ten or twelve others described by various
cases reported are chiefly either instances of traumatic
aneurism arising spontaneously from rupture of a disea
an elderly person; but in one case a cancerous growt
involving the orbit and other parts.

Symptoms.

The symptoms complained of by the patient are, noise
and feeling of tension, singing in the ears, pain in the or
ball, all of which are aggravated by stooping or exert
nevertheless most annoying at night. These symptom
panied by more or less protrusion and impaired mobility o
dimness of vision, much congestion, principally venous, o
and conjunctiva, and chemosis; pulsation (which may be
pressure on the carotid of the same side) in any part of t
communicated to the eyeball, and often a bruit heard on
over the brow or other parts immediately adjoining the or

In most cases these symptoms have come on at a varyin
some injury to the head, or have occurred spontaneously a

Morbid changes.

The morbid changes met with in the three cases ex
death by Mr. Nunneley were in one (in which the disease
spontaneously, and the patient died sixteen days after lig
carotid) a dilatation of the carotid at the point

discovered. The third case was found to be one sease within the orbit, associated with cancerous parts of the body.

y of cases of "vascular protrusion" of the eyeball Cause of vascular protrusion of eyeball.
t within the orbit, but intracranial, the protrusion on obstruction to the return of venous blood, and swelling and congestion seen in the limbs when the ected by aneurism.

derstand how, in a small and firmly bound space like us, a very insignificant dilatation of the commence- halmic artery, or of the carotid itself at any point , or a small hæmorrhage from either, may prove a ediment to the return of venous blood, much more amount of disease situated in the cavity of the orbit

ell known, is not unfrequently met with in the orbit, sily enough diagnosed (*see* p. 439).

matic aneurism of the orbit, which is, I believe, Case of traumatic aneurism.
er my observation in September, 1873.

young gentleman, was, some two months previously, r in which were some bottles of soda water; one of a large piece of glass was driven with considerable t orbit, inflicting a wound in the upper eyelid, just ternal angular process of the frontal bone; the glass rp arterial hæmorrhage occurred, which was stopped h swelling and ecchymosis of the lids followed. The swelling and ecchymosis disappeared, and all appeared ell, but shortly before being seen by me the eyeball ewhat protruded, and considerable congestion of the unctiva was noticed. When first seen by me there as congestion of the eyelids and conjunctiva (no d protrusion of the eyeball in a direction somewhat l pulsating tumour could be distinctly felt near the he orbit; a marked thrill was communicated to the uld be felt on placing the hand upon the closed lids; head was complained of, especially on stooping; there ar cicatrix over the pulsating tumour, marking the al injury.

ic examination showed an extremely dilated and n of the retinal veins, but detected no pulsation; airment of vision.

left carotid at once stopped the pulsation, and caused Effect of pressure on carotid.
ease of the venous congestion.

ix was diagnosed. Perfect rest and pressure applied rt were tried for some months without benefit. It was ned by the patient's medical attendant to perform an dingly, an incision was made over the tumour, and Cure by operation.
vessels which appeared to communicate with it were healed kindly.

ent again at the beginning of the summer of 1874. ad disappeared, the pulsation ceased, and the eyeball its natural position, the only sign of the disease re- small linear cicatrix in the upper eyelid and a slight

thickening near the inner angle of the orbit in the position p occupied by the pulsating tumour.

Treatment. TREATMENT.—Rest, low diet, with depressing remedies, as plied locally, and the administration of digitalis or antimon always have a fair trial. Pressure applied locally, by means and bandage, should also be employed if it can be borne.

Digital pressure. These means failing, recourse must be had to digital pressu carotid, kept up for some hours, the patient being under the of an anæsthetic, as pressure in the neck gives rise to such i pain, that even the most resolute can only bear it for a few m a time.

Ligature of common carotid. As a last resource, a ligature must be applied to the commo on the same side as the disease.

This operation was performed in all but one of Mr. Nunnel with the best results.

Should a case similar to that reported in this article o operation which proved so successful in it should be performed

Exophthalmic goitre.

Exophthalmic Goitre (Basedow's Disease).

This disease is characterised by protrusion of the eyeball, im of the movements of the lids, and diminished sensibility of t and conjunctiva, accompanied by disturbance of the heart's a systolic murmurs in the heart and great blood-vessels of the gether with dyspnœa and enlargement of the thyroid body.

TREATMENT.—Should the protrusion of the eyeballs be very ulceration and perforation of the cornea may occur; this guarded against by protecting the cornea with a small pad bandage applied over the closed lids, or the outer third of the aperture may be closed by operation. These patients are, extremely intolerant of anæsthetics. General medical treatme also be employed; for this the reader is referred to works on medicine.

Tumours, &c.

Tumours of the Orbit, Orbit and Eyeball, and Eyeball alo

Tumours of the orbit alone are—exostoses, nævi, cysts, n malignant growths. Those of both orbit and eyeball ar malignant, and commence primarily either in the eyeball or the other structures within the orbit. Those of the eyeball also for the most part malignant, but simple sarcomatous a growths are occasionally met with.

Tumours of the Orbit alone.

Exostoses. **Exostoses.**—These are of two kinds, either hard, ivory-like consisting of compact bony tissue; or soft spongy growths, of cancellated structure.

Bony tumours are generally met with as hard, more or les scribed outgrowths of varying size, growing either from the bo or from the periosteum. They affect the orbit alone, or may into neighbouring cavities, a fact which should be borne in mi attempting their removal.

Treatment. TREATMENT.—Should exostosis of the orbit give rise to i nience, it may be removed by operation. An incision should b parallel with the margin of the orbit, over the most prominen

growth, which, having been thoroughly exposed, should be removed
ny way which may appear the most effectual, the greatest care being
n to guard the eyeball from injury, and, if possible, to preserve the
inuity of the lachrymal canaliculi and position of the tear puncta. Ivory exostosis.
he removal of the hard ivory exostosis the greatest difficulty will
xperienced, some hours' patient work with chisel and mallet being
sionally required. The operation can, however, be greatly facili-
d by boring through the base of the tumour with a drill worked by
dental engine." The Surgeon who undertakes the removal of such
owth should be aware of the extreme difficulty to be surmounted,
arm himself with a corresponding amount of patience and per-
rance before commencing the operation. The soft, spongy growths Spongy exostosis.
much more easily removed; the tumour, having been thoroughly
osed, can usually be broken off with strong forceps. Should the Fracture of orbital wall during removal.
wth be on the inner side of the orbit, and much force be used in its
oval, the cavity of the nose may be opened and the operator may be
ier alarmed at seeing large quantities of air blown out with the
d. This accident, however, need occasion no uneasiness, as it makes
lifference to the progress of the case; nevertheless, care should
ays be taken not to fracture the orbital walls; should the frac-
take place in the roof, instead of the inner wall, the conse-
nces would be most disastrous, as the cavity of the cranium would
pened.

ævi are not uncommonly met with in or about the orbit, situated Nævus.
rally near its margin, or in the eyelids, but sometimes growing
ly in the orbital cavity. They present much the same characters
other situations, being soft to the touch, of a bluish colour, and
ning harder and more tense during crying or straining.

EATMENT.—The nævus should if possible be excised. Subcuta- Treatment.
ligature is most applicable in some cases, but care should be taken
vent as much as possible subsequent cicatrisation, in consequence
deformity it may produce in or about the eyelids. Other cases
treated by setting up adhesive inflammation within the growth,
use of the galvanic or other cautery, or by passing a number of
etons soaked in perchloride of iron through its substance. The
should be left in until they have set up a slight amount of
tion. Injection of the growth with perchloride of iron, solu-
annin, or chloride of zinc, may also be tried, but the greatest
s necessary, as the operation has occasionally been followed
dden death of the patient.

—Various kinds of cysts are met with in and about the orbit, Cysts.
common being the congenital dermoid cyst (*see* Operations
elids). Simple cysts, probably the remains of hæmorrhages,
connected with the lachrymal gland, are also met with.
ave occasionally been seen.

Periosteal nodes are not unfrequently met with; they Nodes.
rd and sometimes painful tumours, usually situated some-
t the margin of the orbit, but sometimes deep in its
e existence of a node deep in the orbit should always be
l in cases of paralysis of any of the ocular muscles, dis-
f the eyeball, &c., if these symptoms be associated with
forehead or margin of the orbit and other symptoms of
des gradually disappear under anti-syphilitic treatment.

SARCOMATOUS OR CANCEROUS GROWTH may be met with possible they should be removed by operation.

Tumours of Orbit and Eyeball.

Tumours of orbit and eyeball.

The tumours affecting the orbit and eyeball are malignan which have usually commenced within the eyeball and after forated the tunics and implicated the tissues of the orbit. generally of the variety known as melanotic sarcoma.

Melanotic cancer.

The appearance of the tumour varies according to th growth at which it has arrived. In an advanced case a lar mass of a dirty greyish or brownish colour, having a fe covered in parts with dark scabs, in others discharging thin matter occasionally mixed with blood, will be seen protrudi the swollen and distended lids. On closer examination the such) will be found nearly destroyed, portions of the scl remaining in their proper position. The movements of th much impaired, or altogether wanting, the growth having the whole of the tissues of the orbit in one malignant m curious how the growth as it advances beyonds the limits of loses its melanotic character and becomes lighter coloured.

Constitutional disturbance.

The constitutional disturbance in these cases is often s cially when the disease is far advanced.

Treatment.

TREATMENT.—The treatment of these growths depends n extent to which the tissues of the orbit are implicated and the patient's health.

If the tumour is fairly circumscribed, so that there app reasonable hope of removing the whole, and the patient i state of health as to preclude the likelihood of similar other parts, extirpation of the eyeball and other diseased tis be performed, any portions of growth that may be left l wards destroyed by some escharotic. But should the orbit by cancerous deposit that there appears to be little hope o the whole growth, more especially if the patient is in a ca dition, no operation should be thought of, and the surgeon tent himself with palliative treatment, as opiates to relieve attention to the general health.

Tumours of the Eyeball.

Tumours of the eyeball.

(1) **Glioma.**
(2) **Sarcomata**, melanotic, round, and spindle-celled.
(3) **Carcinoma.**
(4) Tubercular deposit.
(5) Pseudo glioma.

Glioma is most commonly met with in children, but occ older persons.

Sarcomata, melanotic, round, or spindle-celled, are usuall in persons of from fifty to sixty years old, and occasionall adult life. The melanotic is the most common form.

Carcinoma has been met with in persons past the middle life, but its occurrence is rare.

Glioma.

Glioma occurs most commonly in children, it commences in and presents the following appearance:—The patient will ge healthy looking and present no signs of cachexia; attention

e eye from a peculiar glistening appearance of the pupil
On examination the surgeon will notice the peculiar reflection
pupil, which is generally somewhat dilated but movable in
nges. Examination, both by means of the ophthalmoscope
al illumination, will show a whitish growth projecting into
chamber, either as a single prominence or in nodules; the
gradually increase, its surface become covered with blood-
etina be displaced, and sight soon entirely lost.

ease progresses the tension of the globe increases, the pupil Progress of disease.
lely dilated and fixed, the iris pushed forwards and nearly
ith the cornea, and the lens opaque, preventing a view of
of the eye; the whole globe now gradually enlarges,
lammatory attacks occur, the sclerotic becomes thinned,
if the growth is allowed to remain, a slough forms near the Rupture of the cornea.
ie cornea, which ruptures, and a fungoid bleeding mass

ase of the growth now becomes much more rapid, and it
) a considerable size in a short time.
the growth becomes exposed to the air it commences to dis-
sanious pus and blood, and becomes more or less coated
y yellow scab. The eyelids become inflamed and swollen,
ks of hæmorrhage may take place, the general health
the patient dies from exhaustion or from extension of the
e brain.
its earlier stages is likely to be confounded with tubercular
in the eyeball or pseudo glioma, but it is not likely to be
en after perforation has occurred.

NT.—The only treatment of glioma is extirpation of the Treatment
his should be done as soon as the nature of the disease has
out; but however early the operation may be performed,
is almost certain to return, either in the optic nerve or

sarcoma, or black cancer, affects persons of advanced age; Sarcomata.
y of soft cancer, characterised by the development of black
ls; it may grow either from the interior or exterior of the
generally commences in the choroid. It is said not to be
recur as glioma. Round- and spindle-celled sarcomata also
nost commonly in the choroid.

NT.—Early extirpation. In all cases of excision for malig- Treatment.
is, the optic nerve must be cut as far back as possible.
a, as above stated, is rarely met with.

ar deposit.—The appearance of this deposit within the eye- Tubercular deposit.
resembles that met with in the early stages of glioma. The
usually children. The deposit is in the choroid; there is
glistening appearance of the pupil noticed in glioma, and
s may be seen upon the surface of the growth; the retina is
displaced by fluid between it and the choroid, and floats in
s chamber. The growth goes on increasing, the pupil
ated, its mobility is destroyed; the lens becomes opaque,
e thinned, the whole eyeball somewhat enlarged, and sup-
y occur; supposing the disease to have gone on up to this
is nothing by which it can be distinguished from glioma.
rever, the difference becomes manifest; the growth, instead Diagnosis.

of increasing, destroying the cornea, and projecting from the eyeball commences to shrink, and with it the eyeball, which becomes soft, and is at length reduced to a small irregular mass. The growth of tubercular deposit may become arrested at any time, and the shrinking of the eyeball commence; in this, again, it differs from glioma.

Appearances somewhat similar to glioma are also produced by inflammatory deposit in the vitreous; the disease has received the name of "Pseudo glioma." It is possible to distinguish the two by the fact that in glioma the anterior chamber is in the early stages of good depth; in pseudo glioma it exists only at the periphery. Moreover, in pseudo glioma there are often evident signs of past iritis, and the tension of the globe is below par.

TREATMENT.—Tonics and good generous diet. In all doubtful cases, and in those in which there is much pain, the eye should be incised.

Inflammation and Suppuration of the Eyeball (Ophthalmitis).

Ophthalmitis.

Ophthalmitis is usually the result of injuries, especially of those complicated by the lodgment of a foreign body within the globe; it unfortunately not unfrequently follows operations for cataract, and is occasionally met with during erysipelas, pyæmia, scarlet fever, &c., and sometimes in women after confinement, especially if the strength is lowered by over-lactation. The disease may begin in any of the structures of the eyeball. Should it commence in the cornea and iris, the former will become cloudy, and soon abscesses will form in its substance, the iris likewise becoming discoloured and covered with pus. The suppuration may stop short here, the cornea and iris being alone destroyed, and the eyeball left with some perception of light (*see* Suppuration of Cornea and Iris). Should the disease, however, commence in the deeper structures of the eyeball, rapid impairment of vision will take place, all perception of light being lost in perhaps a few hours.

If the pupil be clear, pus may be seen behind it, but in most cases all appears dark; the movements of the eyeball are much impaired, and the lids and conjunctiva considerably swollen. As the disease advances the eyeball becomes enlarged and its tension increased, and if left to itself will rupture and discharge its contents, much to the patient's relief. The globe afterwards shrinks to a small button-like stump. Pain is very severe in many cases, but occasionally is altogether wanting. Suppuration of the eyeball rarely sets up sympathetic changes in the fellow eye.

Rupture of globe.

Treatment.

TREATMENT.—This depends upon the cause of the disease, and whether one or both eyes are affected. Should the inflammation depend upon the lodgment of a foreign body, this should be removed without any reference to its position or the state of vision; if the eye have still good perception of light it will certainly be destroyed, and whatever difficulties the surgeon may encounter he cannot possibly make matters worse, and he should not hesitate an instant, or he will lose his chance of preserving any sight that may be left. Any foreign body having been removed, the Surgeon's next care should be to relieve pain, and, if possible, check the progress of the inflammation.

Removal of foreign body.

These indications are best carried out by the application of leeches (if the patient be strong, and can bear bloodletting), by opium internally, and by the constant use of sedative fomentations; the best is the Fotus Belladonnæ (made by dissolving a drachm of extract

Fomentations.

idonna in a pint of warm water) mixed with an equal quantity of
is Papaveris (made by boiling an ounce of poppy-heads in a pint of
r); a piece of rag or lint soaked in this mixture as hot as it can be
e should be kept constantly applied to the affected eye. Poultices
also be employed. Most patients will require the administration
fair amount of stimulant, good food, with iron and quinine.
hen suppuration has been fairly established, and all perception of
lost, the eyeball must be treated as an ordinary abscess and the Incision.
let out by incision.

CHAPTER IX.

AFFECTIONS OF THE EAR.

By Mr. LAIDLAW PURVES.

AFFECTIONS OF THE EXTERNAL EAR.

alformations.—The malformations of the external ear which are met Malformations.
are very varied, extending from cases in which there occur
ntire want of the auricle to those in which the possession of a
le set is seen. In cases where the hearing is not affected by
nalformation, the Surgeon may be consulted as to the propriety
operation with a cosmetic view. He must in these regulate his
on by the usual surgical rules, having regard to any possible in-
ence with the acuteness of hearing which an operation might
l. The most common malformation is a congenital, either partial
tire, want of the auricle, with a failure of the meatus auditorius
nus, or an occluded meatus, the lobules of the ear occasionally
displaced either on to the neck or cheeks (*vide* Fig. 107). But the

FIG 107.



rawing of occluded ears taken from a female patient of Mr. Bryant's, aged
months. Right auricle smaller than left, and more deformed. The pendu-
bodies contained cartilage, the child had likewise a pendulous outgrowth on
nostril.

le may be absent from injuries, and the meatus closed from
, lupus, &c. Such defects do not necessarily occasion an absence
e hearing power, and cases are on record in which patients with
defect could hear sufficiently well to hold conversations with
to whose voices they were accustomed. Before deciding to
te in such congenital cases it is advisable to keep the child under

Treatment.

observation for some time for the purpose of noting if any signs of hearing are developed. Should it be determined to operate, the point of operation may now and again be fixed by passing a current of air through the Eustachian tube and noting the point at which the impingement of air at the end of the cul-de-sac is heard best. This is accomplished by using what is generally called "Politzer's method" (Fig. 108), which consists in passing the soft nozzle of a caoutchouc bag filled with air into one or other nostril of the patient, and while he swallows a mouthful of water, compressing the nostrils with the fingers of the left hand so as to prevent the exit of air through them. At the same moment the right hand forcibly expels the air from the bag in such a way that, finding no passage open except the Eustachian tube, it rushes up them, passes into the tympanic cavity, and pushes out the membrana tympani. It is this sudden rush of air against the external wall of the cavity which the Surgeon listens for by means of a tube of india rubber, passing from the meatus of the patient to that of the Surgeon. In cases of absence of the meatus a stethoscope may be used, by which the Surgeon determines at which point the air impinges most forcibly, and at this point he makes his opening. If hard and bony at this spot, the trephine will be necessary; if soft, the knife will suffice, making a crucial opening and keeping the opening patent by means of tents or other foreign bodies. In congenital cases the opening ought to be made very carefully, watching for the membrana tympani; but should there be no membrana found on cutting down to the usual position of such it is advisable to allow the artificial opening to close again. If the deafness before operating is very great it is probably better to discountenance any operation, as the results of interference with congenital malformations of the ear have generally been by no means satisfactory.

Fig. 108.



Politzer's method of inflating the middle ear.

Cutaneous affections.

Treatment.

Cutaneous affections of the external ear.—Hypertrophy from chronic inflammation, eczema (acute and chronic), herpes, impetigo, pemphigus, erysipelas, affect the auricle, and have much the same appearances, follow the same course, and are amenable to the same treatment as in other parts of the body. Particular attention ought to be paid to any skin affection which may be present in the neighbourhood of the auricle, especially in the hair, careful note being paid to the use of pomade or other application the patient uses for cosmetic purposes. The meatus auditorius externus ought to be cleared once daily by a lukewarm water injection of any collection of epidermis or cerumen.

is apt to be of a greater quantity than normal during the
s of the skin affection.

Injuries to the external ear.

ies to the external ear are by means rare, but, happily, if Injur
d to the auricle, they affect the hearing of the sufferer but
. Under the usual treatment they generally do
re being had to make as perfect an adjustment
parts as possible. In 1866 Mr. Bryant treated
f twelve years of age for the effects of an ulce-
of the external ear some years previously. The
on of the ear is indicated in the accompanying
ing (Fig. 109). By paring the edges of the pen-
portions of the auricle, and the skin covering
e parts behind, a good-looking entire ear was
ith great addition to her comfort.

Fig. 109.



Drawing 224$^{39}/_{4}$

Tumours o
auricle.

tumours of which the auricle may be the seat
othæmatous, gouty, fibro-plastic, fibro-cartila-
sebaceous, erectile, epitheliomatous, and sarco-
. The fibro plastic or cheloid has been already
to as occurring in the lobulus of the ear after
eration of puncture. I have seen many such,
gest having been the size of a walnut (Fig. 111).
enerally do well after excision, but if not tho-
y removed will grow again. The othæmatomatous requires
mention, but the others are to be recognised and treated as
parts of the body.

athic hæmatoma auris, or vascular tumour of the ear, consists, Hæmatoma.
g to the latest trustworthy authorities of a degenerative morbid
nduced by general disturbances of nutrition. The cartilage
uricle is its seat, but the pathological appearances differ, as
e found the perichondrium separated from the cartilage,
ers have found "pieces of the cartilage attached to the
rium." In other cases the cartilage has been found thicker
rder than natural, the thickened part presenting no ap-
f a cyst, but under the microscope showing hypertrophied
lls and intercellular matter. This idiopathic hæmatoma
by a flushing of the auricle, which becomes hot and
In a few hours an effusion of blood takes place, which,
mmencing in the concha, gradually spreads over the
ng firm to the touch, but allowing of fluctuation being
oked for with care (Fig. 110). It is believed to be peculiar
ffering from different forms of insanity, general paralysis
rgest share, melancholia, acute and chronic mania and
owing in the order named. Dr. Hun thinks that the
ns such an exclusive position amongst the insane that
anyone suffering from hæmatoma auris, although sane
observation, ought to be suspected of insanity.
ction occurs in persons who have no hereditary history
ymptoms of insanity is undoubted, but whether the
nges at the seat of the tumour are the same in those
n the other cases in which there is a history of trau-
yet undetermined, though I am inclined to believe

from the cases which have come under my own notice that those resulting from injury do not arise from the same pathological changes.

Treatment of hæmatoma.

Fig. 110.



Hæmatoma auris.

The modes of treatment recommended by different authorities vary. Gruber recommends evacuation of the fluid and coagula and the afteruse of a compress bandage, while Wendt relates a case where vascular tumour recurred twice after incision, but passed off under lead-water applications and compression. I have tried the different methods proposed, once passing a seton through the tumour, and keeping up a slight discharge from it, and find them get well under all the different methods. Since the application of astringent lotions and a compress is less alarming to the patient, and seems as effectual, I am inclined to follow it in future cases, keeping up the compression by a modified letter clip applied to the ear, padding the arms of the clip so as to prevent injury to the skin of the auricle.

Report by Dr. Goodhart on Cheloid Tumours of the Ear.

Cheloid tumours.

The small tumours or thickenings of the skin which usually go by

Fig. 111.



Cheloid tumour of ear.

Fig. 111 gives the microscopical appearances of one of those cheloid tumours from the pencil of Dr. Goodhart.

Fig. 112.



the name of cheloid (Alibert) are of inflammatory nature, with more or less tendeney to become fibrous.

These drawings (Figs. 111, 112), made from a section of one of these growths in the lobule of an ear which had been

...ed for an earring, show the microscopical characteristics. Its ...roscopical appearance was that of a fibrous tumour. It will be ... that, in addition to newly formed fibrous tissue there is also a ...at deal of nuclear germination going on.

Affections of the external meatus.

Affections of meatus.

To examine the external meatus it is usually necessary to employ a speculum for the purpose of straightening and widening the canal, and so allowing of the passage of rays from a natural or artificial light. The specula are formed of silver or caoutchouc and are of various forms. The siver speculum of Wilde, with a round aperture at the narrow end, will be found as convenient as any, it being necessary to have three or four different sizes. If available, sunlight, either direct or reflected from a white cloud, is I think, the best mode of illumination, as it gives different tints of the meatus and tympanic membrane more truly than any artificial light. Seating the patient near a window, with the ear to be examined away from the window, you receive the rays on a mirror either held in the hand or placed on the forehead, and reflect them into the meatus by inclining the mirror to the required angle. If you use the rays direct from the sun itself it is necessary that a plane mirror should be used, the usual concave mirror soon causing such an amount of heat to be felt at the spot on which the reflected rays are thrown that the patient cannot endure a long examination. Should sufficient daylight not be obtainable, an argand burner, with or without a bull's eye lantern placed over it, will act as a good substitute. Having arranged your flood of light so that it falls on the auricle and external meatus, you take the superior and posterior part of the auricle between the middle and index fingers of the left hand, and, pulling the auricle backwards and upwards, you widen more fully the lumen of the meatus, into which you introduce by the right hand the small round end of the speculum. Passing it gently in by a slightly rotating motion, you reach a spot where, there being no foreign body to occlude the view, if the meatus is of a normal width the tympanic membrane will be exposed to view. On accomplishing this, the external edge of the speculum is passed to the care of the thumb and index fingers of the left hand, which move it in different directions so as to throw rays on the different portions of the canal and the tympanic membrane, while the right hand is left free to use the mirror, or, placing the mirror on the forehead, to use any instruments which may be necessary.

Ear speculum.

How to examine ear.

The most frequent change in the external meatus which comes before the Surgeon on thus looking into the canal is an accumulation of cerumen, know by its position, form, colour, and light reflection. It occurs on account of some hyperæmia of the ear, of which a very common cause is the irritation arising from scratching the meatus with pencils, pins, &c.; but anything which causes an increased flow of blood to the lining membrane of the meatus will cause a greater accumulation of cerumen than normal. It also occurs in those much exposed to the sun and dust, in those who perspire freely, and in the old, in whom the cerumen is denser and stiffer than in the young.

Cerumen.

The *subjective symptoms caused by* such accumulations are pain, Symptoms.

vertigo, confusion of ideas, tinnitus aurium, and deafness, the latter symptom being often characterised by its sudden entrance and departure.

Prognosis. The prognosis is not so favorable as is generally supposed. If a vibrating tuning-fork placed on one of the incisors or on the middle line of the vortex is not heard better, or so well, in the affected ear as in the non-affected, you may expect some complication, and the mere removal of the cerumen will not probably be followed by much beneficial result to the deafness. Toynbee gives, as the results of his removal of accumulations of cerumen from the meatus causing deafness, a table of 165 cases, of which 60 were cured, 43 were improved, and the remaining 62 were "either but slightly or not at all improved." Mr. Hinton gives one in six as his proportions of recovery in the same. It will thus be seen that in a large proportion of cases of accumulation of cerumen in the external auditory meatus there is a complication present which does not give way on the removal of the cerumen, and which clouds the prognosis considerably.

Treatment. If you can easily lay hold of the accumulation by means of the forceps without risk of pushing it against the membrane, and without causing pain, it is well to remove it in that way, especially if you are removing it for the purpose of obtaining a view of the parts behind which you wish to examine on account of some affection present, as should there be some abnormality of the parts behind, the passage of a strong current of water might prejudice them. But should it not be practicable to remove the accumulation by the forceps without causing irritation, the syringe must be used in the manner described in treating of foreign bodies in the meatus.

A lessening of the secretion is sometimes seen in acute affections of the middle ear, and in nervous deafness, but, before making your diagnosis in such, inquiry of the patient as to what he has done to the ear before coming to you is useful in eliciting a good reason for the condition found. The use of some slight emollient and attention to the primary cause, if any such is detected, comprises the treatment.

Foreign bodies.

Foreign bodies. In no department of surgery is the aphorism that "blind zeal only hurts" more necessary to be remembered than in that relating to foreign bodies in the ear. The form of the canal is so peculiar, being that of a spiral turning anteriorly inwards and downwards, and having expansions at either extremity, and the forms of the foreign bodies which enter or are placed in the meatus are so varied, that the efforts to remove them by any other means than a current of water must be used only where the practitioner is guided by an accurate knowledge of the anatomy of the external meatus, if damage to the delicate structures which limit the inner end of the meatus is to be avoided. So common are forcible attempts to extract by those unaccustomed to meet such cases, that it is exceptional that a case is seen by the Surgeon before such efforts have been made as have caused a certain amount of inflammation of the canal and its consequent lessening in calibre. In such, where the calibre has been rendered too narrow to admit passage of the foreign body without considerable force, the first indication is to allay the inflammation by rest, leeches, and fomentations, the exudation having been absorbed, and the canal having nearly or

s normal size, the Surgeon ought to determine whether there
n body present, and, if possible, its size, form, and position,
continually occur in which a patient suffering from chronic
the middle ear has the feeling of a foreign body being present,
rs are either the subjects of delusion from other causes, or
ting to delude you. This information is obtained by means of
mirror, speculum, and probe, by the last of which you can
if the body is hard or soft or moves easily. If the last is Treatment.
n may, by inclining the head to the side of the ear affected,
t, or by laying the one hand on the ear a sharp percussion
d so placed may remove it. But the persevering use of an
f luke-warm water from a four- or five-ounce syringe, the
he nozzle of which has a caliber of from one to two milli-
the method which ought to be used above all others, which
h it the least danger, and is by far the most successful. A
held by the patient so that the rim is pressed against the
under the lobule of the ear, the Surgeon draws the auricle
nd backwards so as to straighten the external meatus, and the
ng passed slightly within the external opening and pressed
e upper wall, a moderately forcible current is made to pass
upper wall, sweep across the membrana tympani, and by it
outwards, in which latter course it meets with the foreign
, carrying it with it,
long the lower wall of
nd out at the external
It may be necessary to
e position of the pa-
ad so as to give the
different direction, ac-
the position of the for-
in the canal, the endea-
g always to pass the
rrent beyond the body,
ht to be influenced only
ward rush. Should the
npacted it may be ne-
loosen it by the probe
can remove it by the
ut the first injections
uffice to do this. This
hich is extremely rare,
dy being soft, you may
k into it from the side
ract it; or should it be
for this you may, having fixed it with the hook so as to
passing further in by your manipulations, pull pieces out
means of small kneed forceps and so reduce its bulk
to extract by the hook. When the body is hard and so
at the current cannot have much influence upon it, and a
rceps or hook cannot be obtained, Lowenberg's method of
he point of a camel's-hair pencil armed with joiner's glue or
inous material into contact with the body, allowing the
bstance to harden and thus binding the pencil and the

FIG. 113.



Syringing ear.

When impacted.

that removal is imperative. In such you may be compe
the patient under chloroform, enter the meatus by loosenir
from its superior attachments, or through the mastoid p
reach the offending body and extract. But resort to
measures will only be called for by the most pressing sy
then probably in cases where violent unsuccessful effor
have been made, *as the mere presence of a foreign body in
meatus rarely causes much pain or annoyance.*

Before attempting to remove certain bodies it is neces
them in a condition favorable to their removal, or to
bearable irritation caused by some of them. For exan
cerumen may be so hard that no instrument will pierce
to give the Surgeon sufficient purchase upon it to extr
may be too large to pass the isthmus of the external m
the use of undue force. In such you are compelled to
repeated soakings in hot water or a solution of glyce
alkaline solution, before endeavouring to break it up.
some small animal has passed into the ear and its mo
causing great annoyance by irritating the excessively s
panic membrane, it is necessary to introduce tobacco sm
or a little spirit and water, or oil, to kill it, and at o
irritation before attempts at removal are undertaken.

Modes of softening foreign bodies.

Maggots are sometimes found in the external meat
panic cavity, especially in cases of otorrhœa, and are gene
to remove. Should the membrane not be perforated th
suffice, but, as in the cases in which they are mostly fou
brane is perforated, the forceps is found more effectu
the pain generally occasioned by their presence the
ten drops three or four times daily of a lukewarm s
grain of acetate of lead and a grain of acetate of m
ounce of water, will be found of service. Various kinds
are met with, especially in climates warmer than that
but even in England they are more common than is gener
judging from the cases reported in the medical journals a

ts normal situation, the air-bag or catheter or the vacuum may be of benefit in assisting you to replace it.
of wadding should be lightly inserted in the meatus after the of the foreign body, and kept there for some hours, so as to ie irritated parts from cold, strong noises, &c.
it to be remembered that foreign bodies in the ear may cause ex actions, such as tickling in the throat, giddiness, pain and in the head, vomiting, cough and expectoration, sneezing, a of side, epilepsy, &c.

les of the external meatus originate generally in one of the cles or in one of the ceruminous glands. They occur mostly mptom of some constitutional affection, in which case they ated with boils on other parts, or of some deeper local chronic tory lesion, and are considered in such as a favorable sign. continued use of astringent lotions, especially of alum solu- ns to place the meatus in a condition favorable to their forma- be not the actual cause in some cases. The symptoms they are great throbbing and pain, consequent on the unyielding of the skin and connective tissue of the external meatus to ure from the accumulating pus, fever (especially during the sometimes tinnitus, a feeling of tension in the ear, and more or ess, according to the position and extent of the inflammation. ur at all ages and in all constitutions, but middle age obtains e majority of cases. The prognosis is favorable, though you nable to check the formation of new crops, which go on for even in the most robust people. Furuncles.

eatment is conducted either with a view to arrest the develop- the abscess, or the formation being complete to give the pus Treatment.

The former may be brought about by painting the swelling rong solution of nitrate of silver (ʒss—ʒj to ʒj of water) or a of sulphate of zinc of the same strength. The latter is best shed by a small narrow knife, so narrow in the blade and handle es not exclude your view of the part while making a free in- rough the boil. After making the incision I found it useful a vacuum speculum (Siègle's—*see* article on Affections of the a Tympani) to the meatus, and by suction empty the abscess as possible of pus and at the same time obtain a free flow of m the wound. The application of moist heat afterwards by y filling the ear with warm water, and laying for half an o a cataplasm over the whole ear so filled, of leeches in front gus if there is much pain, or of a plug of cotton which has rated with glycerine (Fisher), changed twice daily, for the pose, and the judicious use of purgatives, result in a favorable ion to the particular boil in question, but the constitutional treat- st follow to prevent, if possible, the development of others. l preventive, Mr. Hinton considered that the application to us of red or white precipitate ointment was of service.

wing of the meatus in the cartilaginous portion occurs not un- y in the aged, on account of the tense tissue-bundles of the and upper walls having become loosened and sunk forwards he anterior wall. This narrowing seldom leads to complete and therefore does not influence the hearing power to any ut its presence prevents the normal exit of the cerumen, and Narrowing of meatus.

so tends to the formation of cerumen balls beyond the narrowed part of the meatus and their results. Other narrowings, besides those which are congenital, arise from thickening of the skin after frequent attacks of inflammation of the meatus, after furuncle and other tumours, eczema, and the long use of astringent lotions or ointments. Except in the case of tumours, you may widen the canal by the use of the *Laminaria digitata* or sponge dilators sufficiently to form your diagnosis and apply remedies.

Treatment. Treat any affection of the tympanic cavity which may be present. Keep the canal clear of cerumen and epidermis by injections of luke-warm water or the passage of a dry camel's hair pencil, and by the use of small ivory bougies, gradually increased in size so that the amount of pressure may be kept up, promote absorption.

Exostoses. **Exostoses of the meatus** are found in individuals of the gouty, rheumatic, and syphilitic diatheses, though their connection with this last diathesis is not well established. They are certainly frequent in the meatus of good livers, who are likely to have their mucous membranes frequently congested. On looking into the meatus an elevation is seen, generally about the middle third, the skin over which is reddened and moist, and pressure on which by the sound causes pain.

Treatment. The treatment is not satisfactory, unless the exostosis has a pedicle, in which case it may be broken off. In other cases, having paid attention to any affection causing congestion of the mucous membrane of the tympanic cavity, the application of iodine to the growth itself, and behind the ear, so as to keep up a slight counter-irritation for a lengthened time, and the exhibition of it internally, offer the best hope of resolution. Should, however, the exostosis prevent the exit of pus from the parts internal to it, the formation of a channel by a hammer and chisel, trephine, dentist's drill, or electrolysis, and the maintaining of it by tents, may be imperative for the purpose of keeping the parts clean and the application of medicaments to the parts beyond.

Hyperostosis. **Hyperostosis of the bony meatus** is seen after a chronic otorrhœa and generally extends through the whole of the bony canal. It is caused by inflammation of the periosteum, which results in a well-developed bony formation. The skin along the narrowed portion of the canal is more or less congested. The treatment is that of exostosis.

Molluscous tumours. **Molluscous tumours** of the meatus consist of accumulated lamina of epidermis and sebaceous matter, enveloped in a thick membrane. Though thus composed of comparatively innocuous material they have the power of causing absorption of the bone lying in contact with it, passing through it by a clean cut aperture without affecting the bony sides of the canal thus caused, and so pursuing their course pass to and press on the parts beyond, causing symptoms varying according to the parts implicated. The diagnosis of this molluscous tumour from exostosis is made by pressing a probe on the skin over the tumour and noting the hardness of the enlargement. Laying open the tumour, washing out the accumulated epidermis by the syringe, and withdrawing by the forceps the lining membrane, is the treatment recommended.

Syphilitic affections of meatus. **Syphilitic affections of the meatus** occur as fissures and ulcerations near the orifice, condylomata, and exostoses. The ulcerations exhibit the usual punched-out irregular contour and discharging surface. The treatment is the usual, general and local.

Inflammation of the external auditory meatus, or otitis externa, is an inflammatory affection of the cutaneous tissues of that canal, involving more or less, according to the violence of the attack, the periosteum of the osseous part of the canal and the membrana tympani. The patient complains of a continual itching sensation, with a feeling of heat and dryness, in the canal, which compel him to pass any suitable instrument which may be at hand into the meatus for the purpose of scratching the part implicated. This irritation may pass off without forcing the patient to seek advice, or it may pass on to one of pain shooting over all the affected side of the head, increased by every motion of the head, or by mastication, and accompanied by a feeling of fulness in the ear, by fever and deafness. After this congested state has lasted for two or three days that of exudation enters, at first as a bright watery discharge, which gradually assumes a mucous character, and this in its turn gives way to a yellow purulent appearance. The pain, which till now has been usually severe, subsides when the purulent discharge shows itself, or soon afterwards, and the patient feels lighter and freer of the sensation of "numbness" or "fulness" of which he before complained. A favorable termination without any treatment may now take place, though more frequently the affection becomes chronic and the patient suffers from recurrent attacks on being affected by any exciting cause. Otitis externa. Symptoms.

In examining the ear it is not always easy to arrive at a satisfactory diagnosis on account of the painful swelling of the canal, which is particularly sensitive about the middle third, and resents the introduction of a speculum. When you are able to introduce the speculum sufficiently well to see the inner part of the meatus you may find a mass of moist or macerated white epidermal lamellæ obstructing your view of the membrane, necessitating the careful use of the forceps or injection of warm water for their removal. Having removed these and obtained a view of the membrana tympani, you find in those cases in which that membrane is affected (and it is rare that you are consulted before it is so), the vessels of the membrane increased in number and size and fully injected, or, if the case has reached a further stage, the single vessels are no longer visible, and the whole has a resemblance to a red blennorrhœic conjunctiva. The natural angle formed by the skin of the external meatus and its continuation with the dermoid layer of the membrana tympani is obliterated, or nearly so, by the pressure of the exudation inside the cutaneous tissues. But the exudation may be so great and may have so narrowed the canal of the meatus that only a small part of the membrane can be seen, its appearance depending upon the part seen and the stage of the affection. The acute stage being neglected, it passes gradually into the chronic form, in which there is generally little swelling of the meatus, possibly here and there slightly macerated or pus-covered spots which bleed easily on being acted on by the speculum, or brown, badly smelling crusts standing upon half-dried secretions. The amount of secretions vary from a moisture discernible at the external opening of the meatus to three or four ounces daily of a high-smelling yellow discharge, and changes by the seasons and other influences. The alarming results of the affection are dependent upon the continuance of this otorrhœa, which, if of long standing, may cause opacity or thickening of the membrane, polypi, maceration of the surrounding tissues, with Appearances.

furuncle, the same layer in otitis externa having the appe
rest of the meatus.

Causes. The causes of inflammation are the passing of any acu
exanthemata to the meatus, irritation or injuries to the
application of heat or spirits to the meatus, the prolong
jections, the pressure of foreign bodies, the passage of col
air or water, the non-drying of the ear and hair round i
after washing, the presence of fungi, and, in short, anythi
congestion and irritation of the lining membranes of the n

The affection may run its course in ten or fourteen
purulent stage has not been reached, but that stage h
vened it lasts from five to eight weeks generally.

Prognosis. The prognosis in a usual primary case under treatment
but relapses are common. The form following an acute
very different, as should the middle-ear inflammatory pr
developed, and the membrane much affected, the chances
entire membrane are lessened.

Treatment. The treatment is etiological. If there are foreign b
their removal demands your first attention, and after this
tion of any purulent accumulation and the use of freque
of warm water are the chief treatment. Should the swell
scarification of the meatus, or an incision and abstraction
the vacuum speculum, seems to be of more use than any
in causing a speedy subsidence of the thickened membrane
may also assist by keeping up a pressure on the circumfe
canal by charpie gently pressed into the meatus, being car
charpie is frequently renewed and the meatus cleared o

Wilde's incision. What is called Wilde's incision, from its having been first
notice by Sir William Wilde, is a favourite means of remed
and in the relief of pain, or as a means of giving exit to a
which may have passed towards the mastoid process, is
It consists in making an incision down to the bone over
process, at a distance of from half to three quarters of an in

or nitrate of silver of from ten to twenty grains to the ounce—are, with attention to any complication of the middle-ear apparatus and to the diathesis present, sufficient to ensure a favorable course. Should the affection have assumed the chronic form, stronger solutions of the astringents mentioned ought to be employed; and the keeping up of a counter-irritation behind the mastoid by tincture of iodine, cantharides ointment, or other irritant, will be found serviceable.

Polypus.

Polypus.

Aural polypi generally show themselves during a chronic purulent discharge from the tympanic cavity or external meatus, and are not only caused by such a discharge, but are themselves a means of increasing it by furnishing an additional secreting surface, and, by preventing the exit of discharge, keeping the parts pressed upon by the pus in an unhealthy irritable condition. They are of different forms and appearances, being of a lively red, rich in blood, soft and easily bled by touching, or firm and solid with a glancing surface, grape-like or ragged, so small that their presence can only be determined by a careful inspection of the deeper parts, or so large that they protrude from the meatus. Their positions are as varied as their forms, as they arise from any part of the meatus or tympanic cavity or membrane, the different authorities not being agreed as to which are the most frequent sites. Happily their diagnosis and treatment are the same, the former being their capability of displacement by the sound, and the latter their removal either by caustics, astringents, the forceps, scissors, knife, hooks, the galvanic cautery, or Wilde's snare. If the polypus is sensitive, which is not usually the case, and the patient will not suffer the removal by instruments, the application of undiluted liquor plumbi, or alum, or tannin powder, regularly for a time, care being taken that each new application meets with a clean surface, will suffice; but the treatment above all others is the immediate removal by instruments as far as possible, and the application thereafter to the root of some caustic, such as acetic, nitric, or chromic acid, by means of a glass rod or piece of wood. The instruments employed for the purpose are numerous, those which I find most useful being Wilde's snare, Durham's forceps, and Hinton's forceps. Wilde's snare is especially valuable, as by its means you are capable of reducing a polypus to a considerable extent without endangering any of the structures near it, while the others have the advantage of easier adaptation to an excrescence which is difficult of reaching. Should the polypus be very small, or so situated that you cannot use a cutting or tearing instrument, the application of a thin layer of nitrate of silver, obtained by heating a crystal of the caustic over the flame of a spirit lamp and placing a probe or piece of stout silver wire against the heated crystal, will be found useful in cauterising it, and at the same time limiting the application to the desired spot, which is not so easy when solutions are employed. After the removal of the polypus, the disease, of which the growth was only a symptom, must be attended to.

Treatment.

Affections of the Middle Ear.

Affections of the middle ear.

Injuries to the Membrana Tympani.—Rupture of a healthy tympanic membrane is usually caused by the introduction of some sharp instrument through the external meatus, the efforts to extract some foreign

Injury to the tympanic membrane.

body from that canal, or by a sudden concussion over the a
a blow from the hand, the unexpected explosion of artillery,
The diagnosis of rupture in such is easily ascertained, but
questions sometimes arise in which it is necessary to deter
a rupture was caused by a blow on the ear or was presen

Rupture of membrane.

blow was given, or whether the membrane was in such a
condition that it would be easily injured. The rupture
membrane caused by a blow is usually a long gaping tear,
depending on the action of the radiating fibres of the mi
the edges of which have a coating of blood upon them.
the membrane is healthy, free of thickening, opacities, c
other deposits, though possibly hyperæmic. On passing
air through the Eustachian you hear a continuous broad
unlike the broken hiss from the perforation of a diseased
unless some time has elapsed since the rupture was ma
case infiltration and exudation may have occurred, giving

Prognosis of rupture.

ances and sounds of a diseased membrane. The prognosis
has formed to some extent, and deafness to a considerab
present, is very favourable, and the perforation will be qu
without further treatment than keeping the membrane pr
cold. Should, however, considerable deafness and tinnit
curred from a blow, either with or without rupture of the
the prognosis is unfavorable, as probably the stapes has
into the labyrinth, tearing the nerve-fibres and possibly rem
there, and you must keep the patient a lengthened time un
tion before giving any opinion of what the results will be.

Myringitis.

Inflammation of the membrana tympani, or myringitis, i
always associated with some affection of the internal or ext
contiguous to it. The diagnosis and treatment will be fo
description of inflammation of the external meatus.

Examination of a tympanic membrane.

In examining the membrana tympani the points to be no
colour, transparency, lustre, light cone, inclination, curvature
tension, whether adhesions are prese
and the position of the malleus, esp
its short process. For a full desc
these we must refer the reader to
'Beleuchtungsbilder des Trommelfill
unden und Kranken Zustande,' Wi
but the following short note of cha
in the most common affections in wh
implicated may be found useful in d
In acute inflammation the membrane
and glistening, and more or less red a
to the amount of hyperæmia present.
the mucous layer is hypertrophied, an
ingly a greater amount of secretion
than in the normal state, the membra
shining than natural, and has a whi
parchment look. If there is a con
accumulation of mucus which has lain in contact with the m
for some time, it assumes a sodden appearance as if the parch
been steeped in fluid. The changes of inclination and curvatu
membrane depend upon closure of the Eustachian tube, adh

Fig. 114.



Appearance of membrana tympani, showing the relation of parts to each other. (Right ear.)

lls of the cavity, accumulations of pus, mucus, or tumours, xternal to the cavity, and perforation or thinnings of the nd can only be diagnosed by seeing numerous cases at an e. The fact that usually only one eye is brought to bear the membrane makes it difficult for the observer to lacement, protrusions, or any changes in which the judg- ice is required till he has accustomed himself to the use of

erforation of the membrana tympani is one of the most ections of the ear on which you will be consulted. The the affection is easy, either by the speculum, by asking the rive a current of air by a forcible expiration through the ubes, the nostrils and lips being held firmly together,—this g called Valsalva's method—by passing a current of air r's bag, as described under malformations of the external ssing the Eustachian catheter and forcing a current of air uth or from an india-rubber bag through the catheter. By ast methods you will obtain—the Eustachian tubes being nd more or less of a hissing character depending upon the umn of air through a small orifice. The usual causes of ion of the membrane apart from those of a traumatic arlet fever, measles, tuberculosis, and any greatly debilitat- in which the mucous membranes are affected. Perforation of the membrana tympani.

osis is regulated greatly by the dyscrasia present, but it s to be remembered that a perforation may heal without discernible pathological changes, and without in the ognisable degree lessening the power of hearing. The ch a happy result are the greater the shorter the acute has caused the perforation, while it is rare after a chronic ompanied by otorrhœa; but no opinion ought to be you have carefully washed out the ear and seen the perforation and losses which have already resulted there- process of healing is known by a gradual diminution of and of the perforation, the cicatrix being formed by the mucous layers, but of a much more delicate structure ural layers, and not separable into laminæ. The hopes of are at an end for the time when the edges of the perfora- cicatrised and a gap still remains, but a new impetus may the regeneration by any future affection which causes a n the part and a softening of the cicatrical edges of the Prognosis. Treatment of perforation.

atment of a perforation the rule is to close it if possible, f the exposure, caused by the perforation of the tender brane of the tympanic cavity to cold air or water, dust and bodies. These by their irritation may cause a purulent d that being once present may lead to results of the most ture. But if the perforation have existed some time, and iderable extent, the question arises whether the closing ation will not impair the patient's hearing power, and anything to close such it is advisable to temporarily close drop of glycerine or other thick fluid and note the effects. result be to lessen the hearing power to any considerable must carefully consider the probabilities before deter-

mining upon your action. While the affection is still in the [illegible] stage, the keeping of the parts clean by gentle injections, and the use of some slight astringents for the purpose of reducing the [illegible] tion of the membrane and bringing it into a more normal [illegible] are all that are required, with the use of a little wadding in the [illegible] when the patient goes out, unless the weather is very mild, when [illegible] latter may be dispensed with. Should discharge be present which [illegible] some means has become thickened, and by its presence closes [illegible] to close the Eustachian tube, Politzer's operation ought to be [illegible] and again; and if this is not sufficient of itself the softening of [illegible] accumulation by an alkaline solution as bicarbonate of soda [illegible] ounce of water, and then the Politzerization will suffice to [illegible]

Closure of perforation. Should you determine to try to close a large perforation by the application of and gently stimulate the edges of the perforation by the application of them of nitrate of silver or other irritant, either in solution or by touching the moistened edges with a thin layer of the crystals placed on a probe as mentioned in the treatment of granulations, or by abrading the edges with a knife, conical file, or plug of wadding turned in the perforation. But if you fail to close it by the growth of new cicatricial tissue, and yet believe that its closure would improve or at least not impair, the hearing capability, you may resort to the artificial drum, the success of which in some cases is very great. Numerous modifications of artificial drums have been proposed, but the most simple, the most easily applied, and one that is as successful as any other is a piece of cotton wadding moistened in water or antiseptic solution, and applied over the perforation and lapping considerably over the edges. The difficulty of its use is its first adaptation, but always removing it at night, and [illegible] directed to attend to the most perfect cleanliness [illegible] wadding. How the artificial membrane acts is [illegible] It is considered that it is a support to the ossic[illegible] this is probably its action in the majority of c[illegible] at the different positions in which they incr[illegible] think they may have also a resonating actio[illegible]

Artificial membranes.

Artificial perforation of the tympanic membrane. **Artificial perforation of the Tympanic** of the means of closing a perforation, it [illegible] artificial perforation of the membrane. [illegible] in cases of accumulations of pus or [illegible] cavity, of impassable stricture of the [illegible] membrane, of adhesions of the [illegible] case of tinnitus, and in cases where [illegible] use of other curative means and [illegible] acoustic is not much affected. Th[illegible] cases cannot be denied, but unl[illegible]

t perforation will benefit this or that case, except in cases of ılation. The point of operation is determined in cases of ılation by the point of the membrane at which bulging is present, n other cases a spot behind the manubrium is usually chosen. ıg the membrane well into view by the usual method, the opera- made by means of one of the numerous instruments which have roposed for the purpose. If it is merely as an experimental ling, to determine whether an opening will be of benefit to the , or for the purpose of allowing the exit of pus or mucus, a plain, double-edged scalpel is all that is required. Having made ening sufficiently large, you remove all impediments to the e of sound by causing an air douche to be passed through the by one of the usual methods, having, if necessary, previously d any accumulations. It being thus empirically determined permanent opening in the membrane would be desirable, you pt to keep the opening from closing by a bougie or Politzer's by making the perforation by the galvano-cautery, by removing of the malleus with a portion of the membrane, by the constant the air douche, by repeated removals of the cicatricial mem- by digestion with pepsine, acids, &c. But as yet no method has proposed which acts with certainty of success.

e ordinary *affections of the middle ear* which the general practi- will be called upon to treat are included under the title of rrhal affections," and may be of an acute or chronic character. principal objective symptoms of acute catarrh are a hyperæmic ng of the mucous membrane, with an increased secretion therefrom, haryngeal mucous membrane near the orifice of the Eustachian eading to the affected ear being nearly always implicated. This f the mucous membrane gives to the observer who passes a current through the Eustachian tube and listens by means of an otoscope, d of which is placed in the meatus of the patient and the other own, sounds ranging from a harsh dry sound, like that caused tending a dry bladder, to a true mucous râle. The tympanic mem- varies in appearance, according to the stage of the affection, from f a glancing polished copper plate to that of a dull wet bladder, which all bright reflex has gone, corresponding to the dry and ted states of the tissues. A more or less obliteration of the s may be present, depending upon the passage of the exudation n the layers of the membrane. A bulging of the membrane observed should an accumulation of fluid have taken place to a erable extent. The chief subjective symptoms are a pain in the of the ear, which is increased by every motion of the parts, such coughing or swallowing, an impairment of hearing, a feeling of ess, fulness or pressure in the ear, often described as "a drop of in the ear," tinnitus of various characters, as singing, knocking, ling, the position of which, whether outside or inside the head, tient cannot always tell, giddiness, confusion of thought, and symptoms of pressure. The subacute form is merely a combina- f the same symptoms in a milder degree. If the case is pro- ttended to while in the acute stage no graver disturbances of anism ought to arise, but it must always be remembered that dency of the affection being to thickening and swelling of the anes implicated, adhesions and solderings are apt to take

Catarrh of middle ear.

Acute catarrh.

place between the closely situated delicate structures of the tympanic cavity. The general position of such adhesions is between the membrana tympani and promontory, the tympanic membrane and incus or stapes, the tendon of the tensor tympani and stapes, and especially often in the niches of the two fenestræ, binding the walls together or to the stapes.

Chronic catarrh.

But should the acute stage be neglected the acute passes into the chronic form, generally, like the acute, implicating both tube and cavity. It may, however, be localised, and consist in repeated swellings with gradual condensations and thickenings of the mucous membrane, which becomes gradually less elastic, and by proliferation forms bands in the cavity. These by their physical qualities as well as by their interference with the swinging faculty of the sound-conducting apparatus materially interfere with the hearing capabilities. The chronic form, once established, is most obstinate to treatment, and leads to increase of the deafness, which depends more on the locality of the changes than on their extent. It also causes an increase of the symptoms of pressure, the tinnitus possibly becoming so harassing that persons have been known to have committed suicide to escape from it, and often causing such depression by the effects of the vertigo and vomiting which it occasions that an inclination to resort to intoxicating fluids is thereby aroused.

Prognosis.

The prognosis is generally favorable, but the treatment is prolonged over such an extent of time that the patient frequently ceases to attend before restoration is accomplished, or aid is not sought in time to prevent changes which, having once occurred, cannot be undone. In these cases we must endeavour to stay the course of the disease, which if left to itself will certainly lead to total deafness. The older the patient, the more chronic the affection, and the greater the changes formed in the tympanic cavity, the less hope is there of a good result. If the tinnitus is continuous, and has been present for some time, the prognosis is unfavorable, even although under treatment the hearing power is improved, while if nearly total obliteration of the cavity has occurred, especially if chalky deposits are present on the tympanic membrane, a favorable prognosis is almost negatived.

Treatment.

The treatment, besides the constitutional and hygienic, consists in local bloodletting, while the pain and hyperæmia are present, the application of the air douche, the injection of medicaments to the Eustachian tube and tympanic cavity, the treatment of any naso-pharyngeal affection which may be present, and the performance of different operations on the sound-conducting apparatus. Two methods of passing a current of air into the tympanic cavity through the Eustachian tube have been already described (p. 443). The passage of the Eustachian catheter, used either for the conveyance of air, fluids, or vapours, or for the better guidance into and through the tube of bougies, elastic catheters, or instruments for electrical purposes, is by no means so difficult as is generally believed. The silver catheter with an obtuse angle of from 110° to 120°, is, I find, the most generally useful in the hands of those accustomed to pass it. The caoutchouc ones are apt to break after being used some time, and do not convey to the operator such accurate knowledge of the position of the beak, in relation to the structures over which it passes, as those composed of metal, although the caoutchouc are less likely to make a false

Method of passing the Eustachian catheter.

n the hands of an inexperienced operator. The patient be placed with the external openings of the nares horizontal osite to the right shoulder of the operator, who, tilting the the nose upwards by the fingers of the left hand, discloses ty of the nares more fully, upon the floor of one of which he the beak of the catheter. Keeping the beak on the floor, he it through the cavity and onwards across the pharyngeal space, comes against the posterior pharyngeal wall, which, in its l condition, gives him much the same feeling of resistance which eives on pressing the catheter against the tense open palm of the . Drawing the catheter towards him, and at the same time ele- g the end which he holds in his hand, he brings the concave cur- re of the opposite end against the posterior edge of the nasal , and then turning the beak outwards and upwards, keeping it at ame time against the external lateral wall of the pharynx, he feel it make a slight dip into the pharyngeal opening of the achian tube. The above method is the one usually adopted, but is that proposed by Bonnefont, which consists in turning the of the catheter from the posterior pharangeal wall outwards Müller's depression, and drawing it then towards you till you feel t has passed over a swelling and then fallen into a depression; wenberg's, consisting of turning the catheter beak inwards after ing the post-pharyngeal wall, drawing it towards you till the catches on the posterior edge of nasal septum, and then revolving vards or downwards towards the lateral pharyngeal wall, when it robably pass into the tube. If there is a difficulty in passing the er through the nasal cavity it is generally most easily overcome ping the beak towards the external wall and passing along it. ould you fail in passing it through the nostril corresponding to stachian tube, into which you desire to introduce it, by using a er with a longer curve you can reach the mouth of the Eusta- tube from the other nostril, or you may pass it into the tube from outh. You know that the nozzle has passed well into the mouth tube by the position of the catheter not being disturbed when tient speaks or swallows, by the fact that the nozzle will not pass r upwards, and especially by the fact that on blowing air into theter, either by mouth or india-rubber bag, you recognise its e into the tympanic cavity of the patient by having placed a f communication from his meatus to your own. In children the rd turn of the catheter is usually more limited in extent than in ult, in whom it is generally from a fourth to three eighths; but a le must be allowed, as the formation of the part varies. In a tient, if you wish to pass the catheter into the Eustachian tube, dvisable to try the right side first, as it will be found usually to pass on that side on account of the septum gently inclining ds the left. The mistake generally made is that the catheter is ought sufficiently forwards after having reached the posterior ageal wall, so that the beak falls into the depression posterior to ening of the tube. But this may be easily averted by attend- the directions above given as to feeling pressure of the curve back of the suptum or soft palate before turning the beak rds.

Weber-Liel, of Berlin, has lately introduced a small elastic

Tympanic catheter.

catheter for the purpose of securing the passage of injections dire into, or the removal of accumulations from, the tympanic cavity. is passed through the usual silver catheter as a director to the and having thus, on its exit from the silver catheter, obtained a tion in the tube, it is passed on with a little care through the tub into the tympanic cavity.

The injections passed through the catheter consist of prepara of potass, ammonia, iodine, mercury, silver, zinc, atropine, chlora in solution, care being taken that the fluid is lukewarm at the ti entrance.

Injections passed into tympanic cavity through the Eustachian catheter.

The following solutions may be found useful:—Sulphate of varying strengths from one to ten grains, of muriate of ammo to twenty grains, of iodide of potassium ten to sixty grains, one to five grains, chlorate of soda five grains, to the ounce of tilled water. Before using them always see that the tube is and cleared of mucus or other removable obstruction to their They are probably most useful when employed every second or third day, for from three to eight weeks, after which an interval of a month or more of rest is advisable before continuing their application. The injections through the elastic catheter, passing directly to the tympanic cavity, ought to be much weaker.

Method of inflating tympanum.

Should objections be made to the passing of the catheter, so that you cannot use it in passing fluids or vapours to the ear, the instruction of the patient in doing Valsalva's method of inflating the tympanum, by which he may drive steam, impregnated with a little iodine and weak ether, will serve the purpose. The method of doing so is as follows:—Having placed from ten to twenty drops of a solution consisting of equal parts of tincture of iodine and acetic ether in a pint of hot water, the patient inhales a mouthful of the steam, and, having closed the nostrils with the fingers, makes a violent expiration, keeping the mouth and nostrils firmly closed. The steam by this forcible expiration is driven against the walls of the naso-pharyngeal space and mouth, and the Eustachian tubes being the only spots for exit, rushes up these and fills the tympanic cavity, a sensation of fulness, and possibly warmth, being felt in the ear by the patient if the operation has succeeded. This ought to be done several times at a sitting, the patient swallowing between each inhalation. But should the Eustachian tubes be not rendered pervious by the force used, as is not unfrequently the case when the mucous membrane is considerably swollen, the catheter must be resorted to, as by the passage of a current from an india-rubber bag directly through the catheter to the tube an obstruction which will not give way to Valsalva's method will be overcome.

The treatment of the naso-pharyngeal space consists in topical application to the mucous membrane of the space of astringents such as alum, tannin, or nitrate of silver. A very useful form is the drawing of a solution of alum up the nostrils, allowing it to pass back into the pharyngeal space, expectorating it, and then blowing the nose violently. When the alum is thought not sufficient for the condition present in the pharynx, a nitrate of silver solution of from 3ss—3j to the water applied to the pharynx, and especially to the membrane round the Eustachian regions, will be found a valuable agent. The patient being seated so that good light is thrown into the mouth, and the tongue

depressed by a tongue spatula or the index finger covered by a he is desired to take a deep inspiration, at which moment Surgeon takes the opportunity to pass the brush, which has been in the solution, to one of the Eustachian regions, and, making revolution upwards, passes over the whole roof of the space to Eustachian region of the opposite side. The use of gargles at between the applications of the caustic is to be recommended.

Professor Gruber and others use what is called the nasal douche, by Nasal douche. from a syringe, the nozzle of which fills one nostril, the other closed by the fingers of the operator, a current of some astringent up one nostril and so into the other, the obstruction to its exit the other nostril by the fingers regulating the force with which it in the pharyngeal walls. But it is so difficult, to regulate that with the resistance of the Eustachian tubes, that the fluid may into the tympanic cavity with such a rush as sometimes to do damage, and accordingly I would not advise its being applied those unaccustomed to its use.

The operations on the tympanic membrane and structures of the Operations on tympanic membrane. are perforation, division of adhesions and tenotomy of the tensor pani. The perforation of the membrane has been spoken of at 458. The division of adhesions and of the tensor tympani is made by small curved bistouries or by revolving cutting hooks made for the purpose. Those of Weber-Liel, and Gruber, will be found most useful. The determination of adhesions, with their exact positions, is best made by using Siegle's pneumatic speculum, by which, on creating a vacuum in the meatus, you are able to note what part of the membrane is bound down and does not fall into the vacuum with the rest of the membrane. It requires a considerably strengthened experience in aural diagnosis to be certain of the necessity or advantage to be derived from such operations.

Otitis media or purulent catarrh is merely a higher grade of in- Otitis media. flammatory mucous discharge, but it has always a much more unfavorable prognosis than simple catarrh. The symptoms are much the same as in simple catarrh, but more violent, being accompanied with severe pain, fever, and nearly always leading to perforation. This, should there be an accumulation of considerable extent in the cavity, is to be desired rather than feared; because should the membrane not give way, as is apt to be the case in a thickened membrane from chronic catarrh, the pus is apt to find its way through some of the many passages which often exist between the tympanic and cerebral cavities, and so cause meningitis.

The treatment is conducted on the usual principles. Give the pus Treatment. every opportunity of free exit, either by natural or artificial channels, and thus allay fever and pain and save time and tissue. Leeches, opiates, purgatives, and warm-water injections into the meatus, keeping the Eustachian open so as to have a natural drain, if necessary, perforation of the membrane at the point of bulging, and when otorrhœa has occurred regular syringing of the ear with luke-warm water, to which an antiseptic or astringent has been added, are what are generally found successful. To make the astringent employed pass into the cavity and through the Eustachian tube it is useful to fill both canals with the astringent, causing the patient to keep it there till you pass a *current of air through the* Eustachian, on which the fluid

or concussion of the body, especially by movement of th
above all, by sucking at the breast, which at last become
that the child refuses to take the breast entirely, preferri
by the spoon. In nearly all the cases of suppuration in t
cavity which comes before the Surgeon, the pus has alre
way through the membrane, and the child is brought to yo

Treatment before perforation of membrana tympani.

of the discharge from the ear. Should you, however, s
before the pain is relieved, you may, by the timely use of
mentioned as useful in otitis media and the free openin
largement over the mastoid process, with, if necessary,
the mastoid itself if there be indications of pus-accumul
prevent the destruction of valuable structures. The gr
the affection is scarlet fever, though measles and typhoi
tribute largely to the number of cases.

Treatment after perforation.

When the acute purulent has become chronic there is a
prejudice amongst both the laity and professional men
stopping of such a discharge by treatment. This prejudic
too strongly combated, as though in such chronic cases the
rally present slight deafness and only occasionally pain, w
be certain that complications arising from the constant oto
as polypi, paralysis of the facial, ulceration, caries and its
not occur.

Affections of internal ear.

Affections of the Labyrinth.—The chief symptoms of th
cases are great deafness, gradually or suddenly acquired, di
the patient's inability to hear the vibrating fork when pl
bones of the skull, vertigo, tinnitus, with possibly nausea
and pain. The conditions causing such affections are beli
hyperæmia of the labyrinth or hæmorrhage into it, inflamm
labyrinth, which is generally in children considered under t
meningitis, and malignant affections. But affections of th
ear are much more numerous as secondary affections resulti
extension of disease of the middle ear, meningitis, fevers
aneurism, anæmia, hysteria, childbirth, or syphilis. With

fully recorded cases is still required before an opinion of its value be given.

Deaf-mutism.

Deaf-mutism.—By far the majority (above three-fourths) of the cases of deaf-mutism arise from congenital affections, the remainder resulting from fevers, teething, hydrocephalus, convulsions, &c. The hereditary influences are undoubted, and when such are present it is often seen combined with retinitis pigmentosa. The pathological conditions found in such are changes in the tympanic cavity with defects in the sound-conveying apparatus, abnormalities in the labyrinth or membrana, especially near the fourth ventricle. But the inner ear or membrana may have no perceptible changes sufficient to account for such a high degree of deafness as is present. The treatment is the careful cultivation of any remnant of hearing which may be present, and the placing of the child in an institution for the education of deaf mutes, where by the careful watching of the lips of the speaker, they are able to follow him in conversation, and by a laborious teaching of the positions in which the organs of speech are to be placed in forming the different syllables, they are rendered capable of answering.

SURGERY OF THE CIRCULATO SYSTEM.

CHAPTER X.

WOUNDS OF THE HEART AND ARTERIES—HÆMOR AND ITS TREATMENT.

Wounds of the Heart.

Wounds of the pericardium.

ALTHOUGH it is quite possible for the anterior mediastin traversed from side to side by a foreign body without any structure being wounded, it is far more common for some se to be the result, such as a wound of the pericardium, heart of the great vessels. A wound of the *pericardium alone* and not prove fatal. Dr. G. Fischer has collected fifty-tw cases of this nature, including punctured, incised, gun lacerated wounds, of which twenty-two recovered. The chi of this local injury lies in secondary inflammation of the From a unique preparation shown by Mr. Morant Baker in at the Pathological Society, it would seem that an omental hernia may take place from the abdominal cavity throug phragm into the pericardium by an aperture, the result of cedent stab.

Paracentesis.

The operation of "paracentesis pericardii" has been with advantage, and generally with the aspirator. The best puncture is probably the left fifth intercostal space near below than the one above, and about two or two and a quar from the median line of the sternum. Dr. J. Roberts, of Ph has tabulated 60 cases of the operation, of which 24 recover pus exists and can be diagnosed, it may be evacuated by an the left intercostal space below the nipple, and the pericardiu as proved by case of Dr. S. West, read at the Roy. Med. Society, April, 1883.

'Trans. Amer. Med. Assoc.,' 1880.

Wounds of the heart.

Wounds of the heart itself are generally mortal, rare inst recovering. Death takes place immediately in about one-fo cases, and in the bulk of the remainder after a few Symptoms.

symptoms of a wound of the heart are very uncertain, but important, says Poland, "is the presence of a *lesion* in the hood of the heart, with *external bleeding*, followed by all th Collapse.

sudden internal hæmorrhage." Sudden *collapse* is a ver consequence of the injury; when it comes on some time aft is probably due to secondary hæmorrhage from the giving clot in the wounded heart. *Dyspnœa*, according to Fischer Dyspnœa.

is not constant; in some cases it is immediate and intense. to be due to compression of the heart by the effusion of blo pericardium and pleura. The *pulse* is often unequal, Pulse.

intermitting. *Pain* is uncertain. The position of the exter Diagnosis.

is a valuable aid to diagnosis, and it is well to remembe

rnal end of the second left intercostal space corresponds to the left le of the base of the heart, and the lower margin of the fifth rib to e apex. In a medico-legal sense it should also be known that "when person is found dead with a wound in the heart, attended with abun- nt hæmorrhage, it must not be supposed that the flow of blood took ce in an instant, or that the person died immediately, and was utterly capable of exercising any power." (Taylor.) The symptoms, as well the duration of life, are much influenced by the direction and size of e wound. Thus, if made in the course of the muscular fibres there ll be little or no hæmorrhage, and consequently less collapse and spnœa; but if the heart be cut across, the edges will separate to a at extent, and sudden death ensue from the immediate gush of blood. oblique wounds there will be less gaping of the edges. With respect he cases of recovery, Sanson has recorded an instance in which a trix in the heart was found some lengthened period after the ipt of a wound from which the patient had recovered in twenty- t days. Velpeau has cited a second, of a man, aged fifty, who nine years after having received a wound in the left side of the t from a table knife, and in whom the pericardium was found ely opened and adherent to the parietal cicatrix, while fibrous lines ersed the whole thickness of the right auricle, at a point corre- ding to the breach of surface in the pericardium. In the 'Medical es and Gaz.' of April 4th, 1874, a case is also reported of a Captain ., æt. 40, who died from dysentery, and after death a leaden bullet, ch had entered the chest above the nipple eleven years previously, found encysted outside the pericardium, between the origin of the monary artery in front and the ascending part of the arch of the ta behind. The heart may also be lacerated by a severe contusion pressure upon the chest without external wound or fracture of the s.—(Thus at Guy's there is a prep. 1400[35], in which both auricles the heart are lacerated with the pulmonary veins which was taken m a child, aged four, over whose back the wheel of a cart had passed. ere is also another in the Royal College of Surgeons of Edinburgh ch demonstrates this point.)—The diagnosis and treatment of this m of injury are the same as in cases of wounds.

Duration of life.

Laceration of heart without external wound.

TREATMENT.—As hæmorrhage after a wound of the heart is the n fear, so to prevent and arrest it should be the chief aim. With s object, absolute repose is essential, and the local and general em- yment of cold should be maintained throughout the case. To m the excited action of the heart, belladonna and digitalis have m recommended, and so even has venesection. The diet should be ritious, but unstimulating. When the pericardium is full of od, it has been suggested to lay open the cavity to let it out, but uncertainty of diagnosis is sufficient to forbid the attempt. For ther information on the subject I may refer to Poland's article Holmes' Surgery,' which contains an admirable analysis of cher's paper; also to a paper by West in the 'St. Thomas's Hosp. .,' 1870.

Treatment of wound of heart.

Wounds of the large vessels of the chest are generally fatal, death g immediate in most cases, from internal hæmorrhage. Dr. Heil, ever, records a case in which a man after receiving a stab which trated the aorta, recovered and lived a year. Pelletan also cites her, in which a man was run through with a foil, which entered

Wounds of the large vessels of the chest.

Examples.

the chest above the right nipple, and came out at the left loin; yet no violent or marked symptoms followed the accident beyond constant pain in the loins. Two months later he suddenly died, in great agony, from hæmorrhage into the right side of his chest, and after death, an opening the size of a quill, was found in the aorta above the diaphragm. The Hunterian Museum (No. 1565a) contains a specimen of the ascending aorta of a sailor, in which was lodged a bullet in a piece of integument surrounded by lymph. The wound was produced by a musket ball passing through the diaphragm and pericardium into the aorta; it entered the chest between the eighth and ninth ribs, and was followed by a rush of blood. All hæmorrhage, however, very soon ceased. The man lived three days after the injury.

Wounds of the Arteries.

On wounds of arteries.

When an artery is *completely cut across* bleeding takes place and the blood jets forth "*per saltum*," as it is called, with each pulsation of the heart. Pulsation in the vessel below the seat of injury is likewise lost. The blood is usually of a bright red colour, unless the patient be asphyxiated, or fully under the influence of some anæsthetic, when it is often as black as venous blood. Pressure upon the artery above the wound arrests or diminishes the hæmorrhage.

Complete division.

Partial division.

When an artery is *only partially wounded*, either transversely, obliquely, or longitudinally, the bleeding will probably be less profuse, and the blood rarely jets out as from a divided vessel, but wells up in a deep *wound*, or flows in a continuous stream, after the manner of venous blood. When the blood is red, its arterial nature can easily be recognised, but when black its recognition is more difficult. Steady pressure, however, above the wound arrest the flow, and pulsation in the vessel below the wound be lost, the probabilities of the blood being arterial are strengthened. It is an important fact to bear in mind, that when a large artery is partially divided just *below* a large anastomotic branch, bleeding will take place from the lower end of the wounded artery as well as from the upper, and pulsation in the vessel below will only be diminished.

Escape of blood may be continuous and colour black.

Bleeding from lower end of artery.

When hæmorrhage takes place from a large vessel, it is generally, unless instantly checked, so profuse as to destroy life rapidly. When from a small, it is less copious, and has a natural tendency to stop at any rate for a time, and to give an opportunity for natural hæmostatics to take effect.

Conditions favorable and unfavorable to hæmorrhage.

Whatever favours *retraction* of a divided artery and its contraction tends to arrest bleeding; whatever hinders these processes prolongs and increases it. Thus, vessels that traverse loose textures cut bleeding more readily than others circulating through those that are close and compact, such as the integument of the head, and sole of the foot; and bleeding from an inflamed or rapidly growing part is checked with greater difficulty than that from other tissues.

Punctured wound of artery. Oblique wound of artery.

The size and form of the wound in the vessel has also much to do with the result. A *puncture in the axis* of a large artery may heal by natural processes and be unattended by much bleeding. A small *vertical* wound may likewise close, whereas an *oblique* wound will not, and is, consequently, attended with copious bleeding, while a *transverse* wound is of all others the most dangerous, on account of the difficulty of controlling hæmorrhage and the improbability of natural hæmo-

art acting with any permanent advantage. The re-
f the vessel tends to cause gaping of the wound rather
encourages rather than checks bleeding.
efore, to consider now how wounded arteries heal, and
leeding can naturally be arrested.

Repair of wounded arteries.

ided arteries.—Small wounds of arteries may heal by
or primary adhesion, and larger may likewise for a
the clot of blood that covers the wound, or even by
parative material; but "the closure of a wound in an
ineffectual or only for a time, and fresh bleedings
reasing the accumulation of extravasated blood or
clots already formed. In this manner, with repeated
uncertain intervals, the wound in an artery is often
t the end of two or three weeks may show no trace of
ier appear widened and with softened everted edges.
is possible that the wound in an artery may still *heal*
either rising from its edges or coalescing over it from
but the *event is too unlikely to justify the waiting for*
there be opportunity for surgical interference, and,
hould go so far as to close the opening in the artery,
be insecure, for both the elastic tissue and smooth-
which its strength largely depends, are very slowly
Hence, a form of traumatic aneurism seems not very
e sacs: hiefly formed of scar tissue, which closed the
ery and then yielded to the pressure of the blood."

Primary adhesion.

Healing by granulation, after Paget, 'Lectures,' p. 204, 3rd ed.

is a more serious injury than a complete division of
requires as prompt surgical treatment, because the
y nature for the permanent arrest of bleeding in a
e acting at a disadvantage, and are rarely effectual in
wounded. In practice, therefore, the Surgeon, by the
of a partly divided vessel, often gives natural hæmo-
nce of effecting a cure. Hæmorrhage from vessels of
ule, ceases after the first rush or, at any rate, as soon
esses for controlling bleeding have had time to act.
ally, with or without surgical help, all the vessels
nd are closed and cease to bleed; the larger being
is end by their retraction among the looser textures,
lation of the blood within or over their orifices, and
on of the heart's force with the increasing loss of
ntly the flowing blood becomes gradually brighter and
he wound be left open after pure blood has ceased to
oozing of blood-tinged serous looking fluid; and this
eeded by a paler fluid, some of which collects like a
he surface of the wound."—Paget.

Partial division of arteries more serious.

Natural Hæmostatics.

Natural hæmostatics.

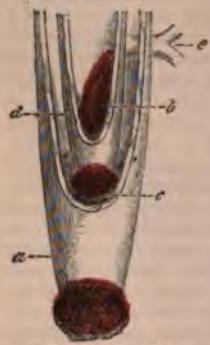
rtery.—*When an artery is divided across*, five things
e divided ends (Fig. 115 *d*) *retract* within the sheath
contracting diminish the calibre of the canal. (3)
in the sheath (*a*) around the orifice of the divided
n the artery itself (*b*) up to the first large branch (*e*);
lastic lymph is poured out from the divided coats of
y its organisation, the permanent closure of the vessel

When artery is divided.

takes place. The clot subsequently becomes organised and contracts. In a large proportion of the cases of divided arteries these natural hæmostatic processes are ample of themselves for the arrest of bleeding, while it is only in the larger arteries that any surgical or artificial aids are required.

When artery is torn across.

Fig. 115.



Natural hæmostatics.

In torn artery.—*When an artery is torn across*, the same changes take place; *but they are carried out to an advantage*, as the stretching or torsion of the vessel before it gives way encourages its "*retraction*" and "*contraction*," and the lacerated edges of the vessel help the coagulation of the blood. It thus happens often that such large arteries as the femoral and brachial, may be torn asunder and no bleeding follow, and whole limbs avulsed from the trunk without hæmorrhage. The lacerated vessel appears under these circumstances as if drawn out, with its external elastic tunic stretched into a funnel form over the inner coats that have been divided and retracted. An artery, however large, divided by laceration or torsion consequently rarely bleeds, and it was the observation of this fact that suggested to Amussat the idea of practising torsion of an artery.

When contused and over-stretched.

In a stretched and contused artery.—*When an artery is contused*

Fig. 116.



Fig. 117.



Laceration and recurvation of internal coats of an artery from external injury. Taken from preparations now in the Museum of the Middlesex Hospital by the kind permission of the Surgeons.

as to suffer something less than complete rupture of all
y become obstructed; and this obstruction is probably
re or less complete circular laceration, or breaking up of
; for the different museums contain preparations which
rtery so treated, when apparently maintaining its con-
ve a complete circular laceration of its inner coats, a
ese coats from the external cellular one, or an incurva-
tunics into the lumen of the artery, as in torsion
7); the deposition of clot subsequently taking place
hes of the divided coats, and, as a consequence, the com-
of the vessel.

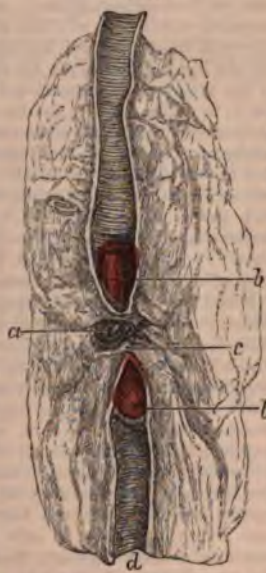
rn this obstruction to follow many injuries, and have Cases.
al iliac artery obstructed in a case of a broken pelvis,
followed by gangrene of the lower extremity, and in a
. I have also known the common and the superficial
, the axillary and the brachial arteries to become perma-
n a similar manner. It
indeed, whether, as a re-
ion, adhesive inflamma-
s place in an artery to
sion without some such
its inner tunics as has

vessel will rupture some
injury, at a part that has
contused, causing a se-
taneous hæmorrhage, and
f something giving way.
however, is rare in civil
ough in military, from
ds, it is more frequent.
nder such circumstances
he fifth day. Cold lotions
, suffice to induce absorp-
od when the hæmorrhage
ough in some cases the
ay be drawn off with a
In exceptional cases, an
form and require treat-

cal Hæmostatics.

n asserted that by na-
s alone divided vessels
tly sealed, and arteries
ccluded; it will be well
quire into the modes of
e different means which
has at his disposal to
ese results; since it may
mine that the means are
l as good, in so far as they
to account the natural
have been described.

FIG. 118.



Secondary subcutaneous hæmorrhage. After contusion of artery.

Surgical hæmostatics.

Effects of carbolised catgut ligature on common femoral artery, taken from a girl æt. 19, who died on the 20th day from gangrenous leg after the application of the ligature to the artery for elephas. The ligature in this case was firmly attached to the vessel, and had acted upon its coats as a permanent ligature.

Exposure of artery and the application of cold.

Thus, *the exposure of, and the application of cold to,* a divided artery favours its "contraction;" this physiological, explaining the practical fact—that on the free opening of a wound, hæmorrhage often ceases never to return.

Pressure upon the end of a wounded artery favours "coagulation" in the vessel, and the value of *acupressure* rests mainly upon this principle; the pins and pressure mechanically arresting the flow of blood, whilst coagulation is taking place in the vessel up to the first branch.

On the action of ligature.

When a ligature is applied firmly to an artery the inner coats are usually more or less regularly divided, and the outer is so constricted as to arrest the current of blood through the vessel. The blood thus arrested consequently coagulates and forms a clot or thrombus, which is, as a rule, conical, with its base towards the ligature and apex pointing to and reaching the first branch (Fig. 118 *b*). This clot subsequently contracts and becomes organised. The inner and middle coats, from their divided edges, pour out (*c*) plastic lymph, which heals the wound, and eventually cements together the outer and inner coats, and the clot into one homogeneous mass; and if in the sequence of events nothing occurred to interfere with the steady evolution of this reparative process all would indeed be well, but unfortunately such is not always the case, for the ligature has often to come away. To this end the outer coat of the artery where constricted must slough or ulcerate, and the vessel itself, in either case, at the line of ligature thus becomes divided. By such action, therefore, what nature by the processes already described might have well done, too frequently becomes undone, and unless a firm clot has filled both ends of the artery, or plastic lymph become organised around the divided coats, the risks of secondary hæmorrhage are very great. It is this fact which makes the practice of arresting hæmorrhage by means of the silk, hemp, or wire ligature so unsatisfactory. To Stilling, and Dr. J. F. D. Jones, 1805, we are indebted for most of our knowledge on these points.

Mode of separation of permanent ligature.

Chromicised or prepared catgut ligature.

When the carbolised prepared catgut ligatures are employed, the primary effects of the ligature are the same as with the permanent (*vide* Fig. 118; 'Trans. of Clin. Soc.,' 1878), but the secondary changes which have been described do not of necessity follow. The prepared catgut ligatures consequently may be regarded as temporary ligatures, which may either dissolve within a few days of their application or become loose. If, therefore, an artery to which such a ligature has been applied does not become permanently closed by natural hæmostatic processes before the ligature has dissolved or become loose, the circulation through the vessel may be restored or secondary hæmorrhage may ensue; and this accident has occurred. The prepared catgut ligature is not, therefore, so safe as torsion for divided arteries. It is, however, a safer ligature than the silk or hempen, as it does not, like the latter, of necessity require an ulcerative process for its discharge.

Flat ligature.

Barwell's flat ox-aorta ligature occludes an artery by mechanically holding the coats of an artery together, and its safety depends upon the coagulation of the blood in the artery and its power of holding long enough to give time for the organisation of the clot. With it there is no division of the inner coats of the artery. I do not therefore believe it to be as safe as the prepared gut or silk ligature.

effects of torsion on an artery.—*When an artery is closed by termed Torsion* the inner coats are ruptured (Figs. 119 B and C), outer (A), when not off, closed by the to which it has been d. But the inner nstead of being sim- ded in a linear man- occurs when the is used, become d, separated from the oat, and incurved, ivided ends turning vessel, and in the rfect examples form- mplete valves, not the semilunar valves heart. The blood, is consequently ar- by this valvular in- n of the inner tunic, es changes precisely to those already de-

Effects of torsion.

FIG. 119.



Effects of torsion upon an artery, showing the incurvation and laceration of the inner coats. From paper by the author, 'Med.-Chir. Trans.,' 1868.

Plastic lymph is out by the divided tunics in the same way as has been shown plication of the ligature, and it acts the same part in cementing rterial tunics and clot together. Between the two forms of prac- vever, there is this difference, that where the permanent ligature used, ulceration of the vessel is prone to occur to allow of its nd this may undo all that Nature has done to seal the artery and hæmorrhage; whereas, when torsion has been efficiently performed hæmorrhage arrested, no subsequent action is liable to undo the rk that has been done or hinder the permanent closure of the vessel. th ligature and torsion, natural hæmostatics are aided in their ut with the former the ulceration set up by the ligature may ma- nterfere with the perfection of the process; while with the latter nothing to prevent the process going on to its completion.

Its advantages.

On Hæmorrhage and its Treatment.

bleeding takes place rapidly from a wound after an injury or n it is called "**primary**;" when it occurs on reaction from ithin twenty-four hours, or in rare cases within two days, it is **recurring** or **intermediary**," and, when after a lapse of a longer "**secondary**."

On hæmorrhage.

"*primary*" is due to the direct injury of the vessel; the "*recur-* the increased force of the circulation during reaction, and the ment of clots that were sufficient to seal vessels when the cir- was feeble; to the overlooking of a vessel during the dressing nd, or to some imperfection in the mode of securing it at the operation. The "*secondary*" is caused by the giving way of y or vein; by ulceration of the ligature; by sloughing of the one or with the tissues around; by the accidental separation of re; injury; or owing to the hæmorrhagic diathesis.

Primary recurring.

Secondary.

Symptoms of external hæmorrhage.

When blood escapes from a wound externally or into a cavity, the term "*hæmorrhage*" is applied; when it is effused beneath the integuments or amongst tissues, "*extravasation*" or *effusion* is said to occur.

The symptoms of external hæmorrhage require no description; the slow flow or the sudden gush of the life's blood being recognisable by all. Those of concealed, internal hæmorrhage or extravasation require, however, some attention. They are those of local injury, *plus* those general symptoms which denote hæmorrhage generally.

Concealed hæmorrhage.

Bell's description of dying by hæmorrhage.

"In slow and in sudden hæmorrhages," wrote John Bell seventy years ago, "the symptoms are very different. In the former the patient is very slowly exhausted; at each return of bleeding the patient faints and is laid in bed, and the cold applications and the fainting save his life. He rises, after some days, pale, languid, and giddy. The pulse flutters, and is hardly to be felt; the breathing is quick and anxious, accompanied with sighing and great oppression; the heart palpitates on the slightest motion; and the slightest inclination of the head, or rising suddenly from the couch, endangers fainting. The voice is low; the eye is languid, colourless, and of a pearly white; the flesh feels soft and woolly, and the skin is pale, yellow, gelatinous, and, as it were, transparent, like modelled wax. After this stage of weakness the blood loses its colour; from this time forward it is a bloody serum only that distils from the vessels; dropsy appears, and the slightest loss of blood proves fatal. But when the patient expires suddenly by an impetuous bleeding from some great artery; when he dies of the bleeding from a femoral aneurism; when he is wounded among the viscera, and some great vessel is pouring out blood, the blood in the general circulation, in place of being forced onwards by the contractions of the arteries, runs backwards towards the wound from all parts of the body. The arteries no longer push on the contents of the veins; the blood ceases to flow towards the heart; the heart ceases to act; and the countenance assumes, as in asphyxia, a livid hue from want of circulation. The face becomes all at once deadly pale, the circle round the eyes is livid, the lips are black, and the extremities are cold. The patient faints, revives, and faints again; with a low and quivering pulse; he is sick; and his voice is lost. There is an anxious and incessant tossing of the arms, with restlessness, which is the most fatal sign of all. He tosses continually from side to side; his head falls down in the bed; he raises his head at times suddenly, gasping, as it were, for breath, with inexpressible anxiety; the tossing of the limbs continues; he draws long convulsive sighs; the pulse flutters and intermits from time to time, and he expires. The countenance is not of a transparent paleness, but that of that clayey and leaden colour which the painter represents in assassinations and battles; and this tossing of the limbs, which is commonly represented as the sign of a fatal wound, is indeed so infallible a sign of death that I have never known any one to recover who had fallen into this condition." ('Principles of Surgery,' vol. i, page 143.)

This sketch is so graphic that I have extracted it as a whole. Since my student days, when I first read it, it has been fixed in my memory. It is, however, only a page out of the work of a master Surgeon which still deserves close study.

A patient may lose a large quantity of blood and yet rally. Children bear the loss of blood badly, yet rally quickly. In old age a small

hæmorrhage is of grave importance, the rallying power being very small.

Local treatment of hæmorrhage.

Treatment of hæmorrhage.—To treat a case of arterial hæmorrhage successfully, the Surgeon, wrote Robert Liston, "must learn to look boldly on the open mouths of arteries." He must know, moreover, that hæmorrhage from any vessel, however large, is readily controlled by the application of well-applied direct pressure *upon the wounded part;* consequently any Surgeon on being called to a case of wounded artery, having cleansed the wound and exposed the vessel, should put his thumb or finger on the bleeding orifice and check the flow until more permanent hæmostatic methods can be adopted. When moderate bleeding comes from a wound and its source is unknown, whether arterial or venous, the mere act of *cleansing the wound and removing clots* is often sufficient of itself to arrest bleeding, not only for the time but permanently. When the bleeding is venous, *the elevation of the limb* has always a most beneficial and rapid action.

Direct pressure.

when "*direct pressure*" is employed to check bleeding, it should be well applied; a small and compact pad, corresponding in size to the last joint of the thumb, should first be applied to the bleeding part, and over this a larger one should be carefully adjusted—a third covering in the whole. These are to be firmly bound down over the bleeding vessel with a bandage or some unyielding strapping, care being taken that the pressure employed is sufficient to control the bleeding, but not enough to arrest wholly the circulation through a limb, thereby producing gangrene of the parts below.

Indirect pressure.

When direct pressure is inapplicable, "*indirect pressure*," as it is called, may be applied to the main artery of a limb above the wound; and for *temporary* purposes this may be efficiently performed by the thumb or finger of the Surgeon or of a skilled assistant; but for a lengthened period this method is untrustworthy, it being impossible for any ordinary man to maintain firm pressure upon a vessel for more than a few minutes consecutively. As a temporary means of arresting bleeding, however, manual pressure is of immense value, and should be applied to the femoral artery below Poupart's ligament for the lower extremity; and on the inner side of the biceps muscle for the upper; the fingers or thumb of the Surgeon being employed according to convenience. In some cases the use of the weight, as shown in Fig. 131, may be recommended.

Esmarch's method.

What is known as Esmarch's method of arresting hæmorrhage has in recent times met with considerable support. It consists first, in the application of an elastic bandage, from the extremity of the limb to be operated on to a point above the site of the operation, and secondly, in the adjustment of an india-rubber band or tube, tightly above the upper border of the elastic bandage, which can then be removed. By this method, the parts below the band have been rendered bloodless, and the Surgeon may explore a limb, excise a tumour, joint, or bone, and even amputate, with the loss at the time of a spoonful of blood.

Objection to method.

The method has, however, one objection, which is that when the band is removed, blood oozes from the soft parts to a far greater extent than it does under other circumstances; the smaller vessels apparently becoming paralysed by the compressing bandage, or from having been completely emptied. The operation which is bloodless during the cutting process is, on the whole, therefore followed by the loss of as

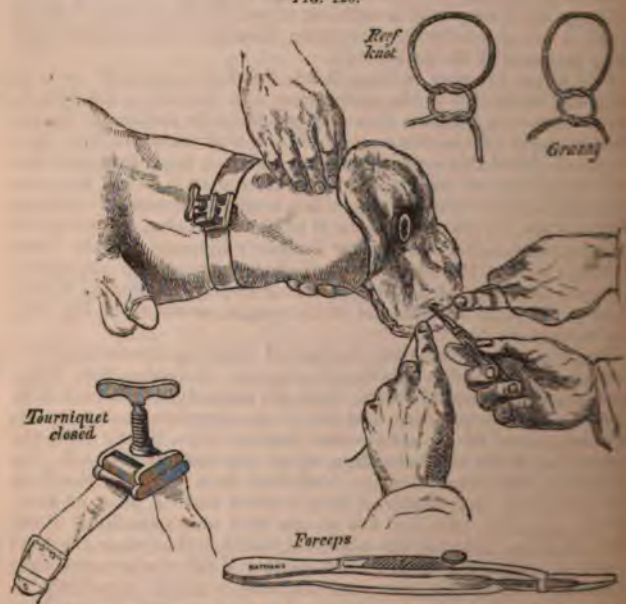
much blood as generally follows other methods. All the good of this method without the evil may, however, be obtained in an amputation by raising the limb for a few minutes before the application of the elastic tourniquet, and smoothing heartwards with the hand the soft parts to empty the veins. I feel bound to add that this method of emptying a limb of venous blood before amputation, was practised at Guy's by the late Mr. Aston Key in 1849, when I was his dresser, in a case of compound fracture which required amputation, and in which it was necessary that the loss of blood should be reduced to a minimum. The case did well. The late Mr. Hilton subsequently often adopted the practice. For exploratory operations and the removal of small foreign bodies, excision of joints, and removal of necrosed bone, the compressing bandage has, however, great advantages.

As first practised by Aston Key.

The tourniquet is, doubtless, an excellent instrument for the compression of an artery, and J. L. Petit's is, probably, the best for the extremities. It should be applied to the limb directly over the vessel to be compressed, the pad being adjusted in the axis of the vessel. The ends of the band are then made to pass round the limb, and are secured either by a buckle or a knot, the former being preferable. The two plates can then be separated by the rotation of the screw, and a sufficient amount of pressure employed to stop the current of

The tourniquet.

Fig. 120.



blood, and no more. (*Vide* Fig. 120.) Lister has invented an admirable tourniquet for compressing the abdominal aorta, and may

rs have been constructed, but these are ample for all ordinary pur- Sub
s of arresting or preventing hæmorrhage. for
When a tourniquet is not at hand, as in the field, a stone or any tour
l substance may be rolled up in a handkerchief, applied over a vessel,
bound round the limb; the ends of the handkerchief too should be
ched to a stick or sword, any amount of compression being obtained
imply twisting them.
s *temporary* means of arresting hæmorrhage, therefore, the Surgeon
employ digital or instrumental pressure either upon the bleeding
, *i.e. direct*; or upon the main artery of the part, *i.e. indirect*. The
nd in both cases should be well exposed and cleansed, and all coagula
oved preparatory to the application of such permanent means as
be at command. Of these, the *ligature*, *torsion*, and *acupressure*
the chief. Styptics and the cautery are only employed when the three
ns mentioned are either inapplicable or have proved unsuccessful.

On the use of the Ligature.

On the u
the ligatu

ince Ambrose Paré re-introduced the use of the ligature (1550),
has been the favourite means for the arrest of hæmorrhage;
speedy way in which bleeding from an artery, however large,
hecked by its application, and the feeling of relief experienced on
wing that for a time, at least, all fear of bleeding has been re-
red, having so influenced the majority of practitioners in its favour,
o induce them to put aside, untried, all other suggested means as
g unnecessary. It took, however, more than two centuries for the
ture to become established in practice; in fact, its adoption was not
ral till Dr. J. F. D. Jones had demonstrated by his experiments,
dy alluded to (p. 472), the physiological processes by which hæ-
hage is naturally arrested in a bleeding vessel, and, that by the
ure, these were utilised.

tie an artery efficiently, the vessel should be taken up cleanly, Mode of
n out, and tied with a smooth cord of prepared silk, or catgut, ligaturing.
sufficient force to rupture the inner coats of the vessel (such a
, although desirable, does not appear, however, to be constant), and
e the outer coat; the ligature should be made secure by what is
the sailor's reef-knot; the Surgeon's double-knot should not
d. In forming the loop the ligature should be pressed down
artery by the finger or thumb as indicated in the drawing
20), otherwise the extremity of the artery will, if diseased, be
be broken off.
the vessel is deeply placed and cannot be isolated, it must be
d with some of the adjacent tissues. When it is so embedded
free end cannot be taken up with forceps, a tenaculum may be
eneath the bleeding vessel and all the tissues taken up by the
nt should be strangled by the ligature. The ends of the liga-
to be left hanging out of the wound, but at the present time
ice of the late Mr. De Morgan, which is a revival of that of De Morgan
entury, of cutting off both ends of the ligature, leaving the cuts off bot
d and closing the wound, has become general. ends.
he vessels are diseased and brittle, extra care is needed in Ligature of
tion of the ligature. The vessel should not be tied too diseased
too much of the artery be torn and the ligature be made arteries.
before natural hæmostatics have closed it. Some have

importance in maintaining the lacerated inner coats in position, by allowing blood to coagulate, and lymph to organize between them. With this caution diseased arteries appear to be as amenable to the treatment as the healthy, and torsion requires no more care under these or any circumstances than the application of a ligature.

Arguments in favour of torsion.

The physiological arguments in favour of torsion are unanswerable, while the practical advantages seem to be not less. After fifteen years' experience of the practice among vessels of all sizes (the femoral being the largest) I have had no mishap. I have further observed that wounds have united more rapidly and kindly—primary union being the rule; there has been less constitutional disturbance after operation and consequently less liability to traumatic fever, pyæmia, and other complications such as we are all too familiar with in the practice of surgery. Stumps have healed in a week, and patients have up in two, without one single drawback, rapid and uninterrupted convalescence following the operation. In other cases, equally good

Statistics of torsion.

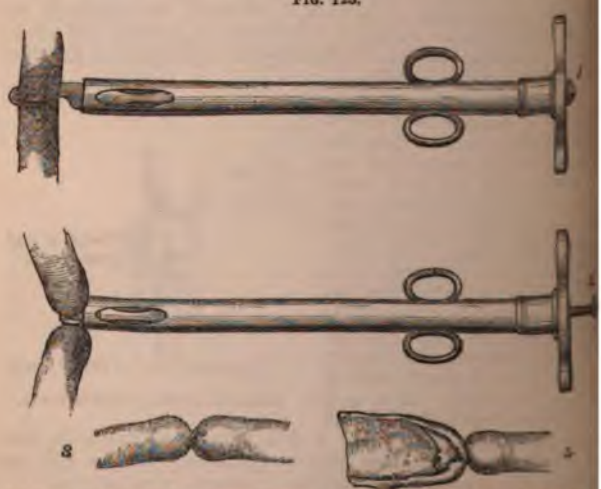
success can be recorded. At Guy's Hospital we have had two hundred consecutive cases of amputation of the thigh, leg, arm, and forearm, in all which the arteries had been twisted (110 of these having been of the femoral artery) and no case of secondary hæmorrhage.

The artery constrictor.

The Artery Constrictor.

Dr. Fleet Speir, of Brooklyn, New York, has had an artery constrictor made (Fig. 123) which, as he has demonstrated upon both the

Fig. 123.



1. An artery taken up by the constrictor. 2. Artery constricted. 3. Effects of constriction upon vessel. 4. As seen when laid open.

How it acts.

living and the dead, has the power of dividing the inner coats of artery and allowing them to recurve, as in torsion. He has used it

ressels except the iliac and subclavian, and has never had
nion chiefly by first intention having followed ('Med.
York, April, 1871, and 'Archives of Clinical Surgery,'
76).
ient he recommends (Fig. 123), should be "tight-fitting
strict thoroughly, and yet grooved and smooth enough
'e the external coats, while it makes a *complete in-*
the inner coats. For operating upon vessels in con-
aneurism, I prefer to place the limb, after constriction,
osition, so as not to stretch the vessel after being

the instrument is shown applied to an artery, and in
a section of the artery, subsequent to its constriction.
this instrument on the living, and have made a large
eriments on the dead, and find it does all that Dr. Speir
elieve it to be of value for obstructing arteries in
it does for such precisely what torsion does for divided
lay, 1882, I employed the instrument in the case of a
ith popliteal aneurism with encouraging success. The
by "quick union," and the aneurism was cured. 'Brit. Med. Journal,' vol. ii, 1882.

Other Methods.

or styptics are valuable agents in the arrest of bleeding, On styptics and astringents.
ins previously mentioned are inapplicable; their value
creased when combined with pressure. The perchloride
of iron, pounded matico, alum in powder or solution,
eeding surface on a pad of lint or dossil of cotton wool,
are the best applications; though tannic acid, Ruspini's
of turpentine, are also serviceable. Before applying any
bleeding part should be wiped as dry as possible, and
noved. In uterine surgery, injections of some of these
e much used. In rectal surgery, the bowel may be
lint or sponge saturated with a styptic, and in epistaxis
be plugged in a like way.
a powerful styptic, cold air often permanently arresting Cold and heat.
æmorrhage on laying open a wound. A stream of cold
to a bleeding part, or ice pounded and placed in bladders
aid on bleeding wounds, are at times of great assistance.
is equally good, and when applied in the form of a hot
out of an iodine or antiseptic lotion, is enough to stop all
g. I have adopted this practice after operations for
th excellent success.
on, which was the common mode of arresting bleeding by On cauterization.
is now seldom employed; yet it is a valuable agent in
either torsion, ligature, nor acupressure, is available. In
from which blood is oozing, and also in other cases, the
ften act most beneficially. It may be applied through
or cones brought to a *black heat* by means of fire, or
um or porcelain instruments, heated by means of benzoline
galvanic battery. In any case the heat should be enough
eschar upon the bleeding part, while care should be ex-
uently not to remove this too soon; indeed, the eschar
e left for natural processes to throw off. In no case

Summary of the treatment of hæmorrhage from wounded vessels.

All divided or wounded arteries, from which blood flow
sible, to be twisted or tied at the seat of injury; and
this, when room is required, the wound may be enlarge
artery is "*divided*," *both ends* are to be dealt with separ
an artery is "*wounded*" John Hunter's advice is still
apply the tourniquet, then lay the artery sufficiently ba
vessel above and below the wounded part," MS. Lec
some cases the vessel had better be completely divide
brachial, I have followed this practice on three occasions
its two ends, with good result, and advise its adoption
practice in arteries of less calibre. In larger arteries it is
good.

When there is no bleeding present, an operation is
although, in exceptional cases, when a renewal of the hæ
endanger life this rule may be deviated from.

When *moderate* arterial hæmorrhage exists and the
be taken up in the wound without an operation, the gr
press may be employed with a fair chance of success;
fail, the vessel must be secured.

When arterial hæmorrhage endangers life and the art
treated at the wound, the trunk of the vessel is to be
the wound.

When *recurring* hæmorrhage is severe, the wound is to
or enlarged, all clots turned out, and the vessel tie
When moderate, it can be treated by elevating the part
over either the main trunk of the vessel or the wound, a
plication of cold, such as the ice-bag.

At times all bleeding ceases on the mere exposure
wound; at others there is merely a general oozing. Un
cumstances, if exposure of the wound to the air, or to a s
water fails to check it, well-applied pressure will ofte
exceptional cases, styptics may be required.

Treatment of "*Secondary hæmorrhages*" are to be dealt with in t

here is less contraction and retraction of the vessel, less perfect lation of blood, and less effusion of plastic lymph.

enous hæmorrhage," unless from the trunks of large veins, quickly , usually from the collapse of the veins. Where any impediment to the return of the blood from the wounded part it may, how- prove troublesome, yet its arrest will probably be secured on the al of the obstruction. The elevation of the wounded part will much towards this end, as will also the application of cold, or pressure upon the spot. Venous hæmorrhage

hen large veins are divided and the bleeding is copious, they must be r twisted. When veins are wounded they should be divided and to close a small opening into a large trunk with a fine ligature, is afe practice. Wounds of veins heal rapidly, as is seen after vene- n. Wounds of large veins.

uries of the large venous trunks, however, are of grave import- and any wound or injury that induces, directly or indirectly, the lete arrest of the venous circulation through one of these, is pro- of greater consequence than the wound of an artery. The al jugular vein has, however, often been tied with success.

ein is known to be opened, when black blood flows from the wound steady stream and from its distal part, when pressure above the d increases the flow and pressure below retards or stops it.

lebitis is the chief evil to be feared from an injury to a vein, and it occurs, it is very fatal. Veins, however, will doubtless bear more manipulation than our forefathers believed, without any danger ensuing. Phlebitis.

entrance of air into a wounded vein is a source of great danger; e subject will receive attention in a succeeding chapter. Air in veins.

eration of arteries in contact with pus occasionally occurs in subjects, and when the artery is large death may follow. I st a case of iliac abscess from this cause, the deep circumflex ery having been opened; many similar examples are on record. he hæmorrhage is recognised and the source of bleeding known, oratory incision is called for, the opened artery should be s a wounded one. Ulceration of arteries.

The General Treatment of Hæmorrhage,

On the general treatment of hæmorrhage.

f importance, is subsidiary to the *local*. When *syncope* has e from loss of blood, the Surgeon should not be too hasty to t, since it is without doubt one of the most valuable means ploys to check bleeding and to assist natural hæmostatics; same time, great care is needed that the syncope be not uch an event appears imminent, the patient should be kept ontal posture with the head low; cool air should be allowed the face, or cold water sprinkled over it; some diffusible ch as ammonia, ether, chloroform, or the nitrate of amyl, ed, or brandy given in small quantities. In extreme cases s advise pressure being made upon the abdominal aorta or to confine the blood to the nerve-centres; or, even trans- employed. This operation, however, has never been in ith Surgeons; though from accoucheurs it has received pport, the late Dr. James Blundell having given it his acy. When attempted it should not be delayed until Syncope.

opium, say a grain, is often very valuable.

When the hæmorrhagic diathesis exists, iron in full dos service, the tincture of the acetate or perchloride in half- being the best. Oil of turpentine is likewise a valuable rem minim doses being sufficient for an adult. Gallic acid doses, and acetate of lead in one-grain doses, are also be these act upon the blood and dispose it to coagulate.

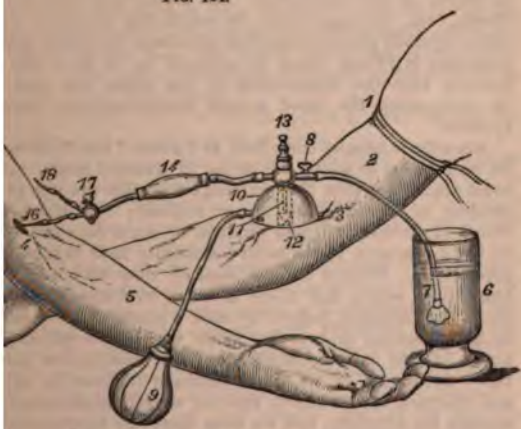
Transfusion.

Transfusion.

When Dr. Lower, of Oxford, with Sir E. King, in 166 tised transfusion, blood was drawn from an artery a *directly* by means of a tube into the vein of the patie being propelled simply by the force of the circulation of As time progressed, the inexpediency of opening an artery the plan of transmitting blood from vein to vein came i 1785 this plan was also warmly advocated by Dr. Harw bridge. With this change of practice, the mode of oper be altered, because the force of the venous circulation wa insufficient to propel the blood. The *indirect* or *medi* operating consequently came into use, the blood of the e received into a vessel and transmitted by a tube or syri vein of the patient. To James Blundell is due undoubted of having devised an apparatus by which the operation ently performed. He called it first an "impeller," and wh a "gravitater" ('Lancet,' 1829). Since his time D Hewitt,[1] Braxton Hicks,[2] and particularly Roussel, hav towards rendering the practice more safe and certain. T the Surgeon in the operation is, to tranfuse blood from a h bloodless patient, and his aim should be to prevent the c the healthy blood during the operation, as well as to guar introduction of air into the veins. This operation sho undertaken when a trustworthy apparatus is at hand, and Roussel's is without doubt the most complete. Aveling's

ounded by a rigid cup which can be exhausted by an (9) in connection with it. The exhaustion of this cup the apparatus to the arm, but also increases the tur- vein over which it is applied. The cylinder within it losed by the introduction at its upper extremity of a e exact depth of which can be regulated (13). Before air should be driven out of the cylinder and tube by ith tepid water (6), in which a little bicarbonate of soda ed, by means of the syringe (9), and the tube (8, and 7), hed to the cylinder opposite to the conducting tube (17). o operate the lancet (12) is depressed into the vein. emity of the conducting tube a stopcock (17) with two d 18) is attached, the stopcock being inserted to direct id into one or other of the canulæ. One of these canulæ into the vein of the recipient (5). The apparatus d with water, the vein is opened by the lancet and the e cylinder and tube pumped out through the free canula od only flows through it. The stopcock (17) is then he blood is injected into the patient's arm through an vein (4). The syringe by this apparatus "forcing the vein of the recipient by degrees as it draws it from the

FIG. 124.



Dr. Roussel's injecting apparatus.

onor, every particle of it having remained less than a the human vessel, enclosed in a full tube, and the blood an artificial vein and heart, hermetically closed, damp, t as are the human vessels. The blood is not modified fibrine, globules, gas, temperature, or density; it passes em to another with all its primitive vitality, and con- on."

an six to nine ounces of blood should be transfused at

one time, the injection too should be gradual, that is, about six syringefuls a minute.

DISEASES OF THE ARTERIES.

On arteritis and atheroma.

Arteritis.—Under this heading, besides the rarer forms of disease, we shall include atheroma, as there is no longer any question of its inflammatory nature. Of this, Virchow, Billroth, Wilks, and Moxon, have given sufficient evidence, though in modern text-books the old view is still taught, and the weight of Gulliver's investigations ('Med-Chir. Trans.' vol. xxvi) has not yet lost its influence. We by no means think that Gulliver was altogether in error in holding that atheroma was a fatty and calcareous degeneration of the inner and middle arterial coats with subsequent thickening of the adventitia; on the contrary, it is not improbable that atheroma may sometimes be a simple retrograde metamorphosis of the arterial tissues; but, there can be no doubt that it more often begins as a sub-inflammatory process. This conclusion has been reached partly upon histological grounds and from the fact that the disease is most prone to occur where the wear and tear is greatest, and inflammation, consequently, most likely. Syphilis has, doubtless, much to do with arterial disease and as a consequence with aneurism, and the frequent association of syphilis and aneurism in the army has been adduced as strong evidence in favour of the conclusion. Mr. Myers has, however, shown ('Path. Trans.,' vol. xx, page 134)—by comparing the army with the navy—where syphilis and over exertion are about the same, that in the former aneurism is fifteen times as common as it is in the latter, and he believes that the constriction of the collar and coat of the soldier by obstructing the blood stream favours arterial disease more than syphilis.

Effects of syphilis.

Forms of arteritis.

Arteritis is usually described as "acute" and "chronic," and it will be well for us to adopt the terms in general usage. But the student must remember that the pathologist applies the one to a process the product of which is cellular or nuclear; the other, to that which shows organized or tissue product, or some degenerative change such as the calcareous, which must necessarily have taken some time in its production. From a clinical point of view both terms are more arbitrary than exact, and there is other evidence than pathological to show, that changes, judged by such a standard to be chronic, are rapid in their course, and, in the same way others which must be called acute, in that microscopically they are cellular, are not necessarily of short duration. If we, then, continue to describe arteritis as acute and chronic, it is evident that no strictly histological basis is broad enough for accuracy, and we have therefore adopted that classification of acute arteritis which accords best with our own experience.

Acute form.

"*Acute arteritis*" is found under four conditions:

1st. As slightly raised greyish or pellucid patches on the lining membrane of the artery, which, when examined microscopically, show a multiplication of the cells of the superficial layers of the inner coat. It is a disease which is not, perhaps, of much importance when attacking the aorta or larger vessels, but, when it affects the smaller arteries, it may lead to a considerable diminution of their calibre, thrombosis, and thus to all those changes which ensue when the circulation becomes arrested. It is a change of this kind which Hunter

tely described in the vessels of the brain as particularly liable to cur in the subjects of syphilis; and it is probable that a similar sult may be induced in the larger arteries from the same cause.

2nd. As a general affection of the arch of the aorta, in which that ssel is greyish, softened, thinned, and dilated, but without any strictly heromatous or calcareous change in it. It would be better perhaps call this state, acute softening, though the nature of the process is sentially inflammatory.

3rd. As a local disease in the arch of the aorta in cases of acute eumatism. This is rare, sometimes originating in the friction oduced by large valvular vegetations which are washed backwards d forwards in the blood-stream, and sometimes without any such use and apparently as a spontaneous arteritis. In either case, it is ble to lead to aneurism or imperfection of the aortic valves.

4th. As a local disease in the arteries, secondary to the lodgment of boli, which, by their presence, set up an arteritis.

Chronic form.

"*Chronic arteritis*" may occur as a widespread and continuous disease most of the arteries of the body, or as one which is localised to various rts, specially the larger vessels. Of the former, a very rare disease, amples have been published by Wilks ('Guy's Rep.,' 1869), and wory ('Med.-Chir. Trans.,' 1856). In Wilks's case the principal teries of the body were thickened and obstructed, the vessels being led with old clot that was "so closely adherent that the wall of the ssel would split rather than part from the clot. At both the ending d commencing parts the clot was white and like fibrous tissue, and uld not be distinguished from the coats, which here were swollen d atheromatous. The atheroma, indeed, appeared to be here in the also as well as in the arterial coat."

Obliterative arteritis.

There seems little doubt also as to the fact, that a vessel may become pletely obstructed by a strictly local arteritis.

may be noted in passing, that the descriptions of the naked-eye arances in these cases, exactly correspond with that of the so- d syphilitic disease of the cerebral arteries just alluded to as having described by Heubner, and which has been classed by us as acute itis, inasmuch as it is a disease purely cellular.

Moxon's views of diseases of the coats of arteries.

ch cases as the last, however, are rare compared with those of hronic arteritis, such as is met with in the arch of the aorta at its ation and other parts. It is indicated by thickening of the vessel ss of its elasticity, by the external coat changing into a tough tissue, and the affected parts, instead of feeling thin and pliable, ng hard and leathery. "Now, such changes as these are com- present along with the atheromatous pulp in the deep inner d these are the part of the changes that go by the term a as commonly accepted. Changes of a kind that cannot be as other than inflammatory are present in nearly all bad of atheroma; the extent of the inflammatory changes surpasses that of the atheromatous, and these inflammatory ccur often without any atheroma, and especially in younger bout or under middle age. The more inflammatory changes e to produce aneurisms than do the atheromatous patches. eroma is thoroughly established, so that a pulpy mass is the coats at any spot, this is generally thick and hard and and does not give way to pressure so as to form an aneu-

rism. The disease that leads to aneurism is the same disease as leads to atheroma, and I think it is a correct way of describing these relations to say that they are alternative results of the disease of the coats. I mean so that if the sub-inflammation is severer, then the coats are softened and yield early, before the thickening and stiffening chronic process that leads to the atheroma patch has time to occur. On the other hand, if the sub-inflammation is lower and slower, then there is not such softening at any time in its course as to lead to aneurismal yielding; but the result is a slow thickening, which reaches a considerable and a sufficient degree before any fatty degeneration occurs within it, and then always the thickening goes further than the granular change, so that the wall of the artery is rather stronger than weaker; and if the sub-inflammation be yet slower and slower the fatty or granular change in the coat goes on to an accumulation of lime salts or petrifaction of the spot, the stone in the wall showing sometimes some rude bone cells, so that ossification may be thought really to occur, though the bone is truly a very rough production, if it be bone at all. Now, if instead of being thus slow, so as to give time for the calcareous change of its products, the sub-inflammation be very acute, then the arterial wall may rupture, and either sudden death or a false aneurism be the result." "I might," adds Moxon, "give practically any number of cases and drawings, showing the active cell formation in cases of atheroma, this cell formation found in the deep layer of the inner coat especially, and causing the production of little nests of cells, in which fat and lime soon accumulate. In severer cases the middle and outer coats, and the deep layer of the inner coat, are seen to be charged with lymph-cells in enormous numbers, crowded together, and separating the proper elastic and the muscular fibres into little patches and shreds, while both elastic and muscular fibres fall into a state of fatty degeneration."—Moxon, 'Guy's Hosp. Rep.' 1870-71.

Active cell formation in atheroma.

In Figs. 125 and 125A, taken from drawings kindly made for me by Dr. Moxon, these changes can be seen. His description is appended.

Dr. Moxon and others believe, and I think rightly, that mechanical strain is the main cause of atheroma of the arteries. It is chiefly found at points where the strain upon the coats is greatest and in men who follow laborious occupations. Gulliver originally described it as a disease of the larger arteries, but it is now known to involve the whole arterial system.

Mechanical strain cause of atheroma.

In advanced disease calcareous plates are found in the larger arteries, while the smaller are converted into completely solid tubes. The vessels, moreover, alter in shape, and become tuberous as well as tortuous—dilatation taking place at the points of bifurcation. When the disease is very extensive or advanced, the inner coats become destroyed and undermined with blood. When this undermining takes place to any extent, what is known as a *dissecting aneurism* may be produced; but in other cases the inner coat is so raised by the clot of blood behind it that the arterial canal becomes closed, and gangrene of the parts supplied by the occluded vessel may ensue. In a preparation in Guy's Museum (1465), the aorta was thus affected, causing gangrene of the extremities. In others, the vessel may rupture, and cause death from hæmorrhage. In rarer cases, the vessel may be completely closed by the calcareous disease; in some the roughened raised patches become the centres

Formation of dissecting aneurism.

s adhesions which may either cause occlusion of the vessel their size, or indirectly by being carried into more distant emboli. In both cases gangrene of the parts thus deprived ill be produced. *Senile gangrene* doubtless is occasionally

Fig. 125. Fig. 125a.



s the incipient inflammatory stage of the change in an artery which leads ma, and in which aneurism usually occurs.
ws the final degenerative stage of the same change in the artery which s atheroma.
mall portion of a fine section of an artery from the neighbourhood of an ; the artery was here soft and swollen, and had a more pellucid and pearance than natural. A small and early patch of the disease is repre- The cells of the artery-wall are found enlarged, their nuclei multiplied, e centre of the patch they burst towards each other to make a cluster of ved from the multiplied nuclei.
ken from the same artery at another spot, where the coat had the well- ellow appearance of atheroma. Here the patch of multiplied cells has ed to a heap of oily and earthy matter with some plates of cholesterine. idual cells around are seen to be degenerated in the same way. Some of he upper part of the figure are, on the other hand, developing into elastic his is a frequent accompaniment of the atheromatous process, and its o ultimately strengthen the arterial wall at the diseased spot.

is manner. Thus it is seen that this atheromatous disease of is often the cause of gangrene of a part by direct occlusion l as well as by embolism. As a general rule, however, in ces in which portions of artery are found to be withered and nto fibrous cords, evidence is wanting of arteritis being the cent investigations having tended to show that such changes tural result of an obstruction of the vessel, and that this is probably due to a plugging of the canal by a clot, or to known as an embolus.

Atheroma often a cause of gangrene.

generation of the inner, and a primary calcareous change in lar or middle coat of medium-sized vessels, must also be These may be, and no doubt are, mostly associated with ammatory changes in the arterial system, but there is also lieve that sometimes they are essentially primary degenera- lead to contraction of the vessels and senile gangrene, as do us changes.

Embolism

On embolism.

is a somewhat common affection, and consists in the occlusion of a vessel, large or small, by a plug of fibrin or calcareous matter, carried by the blood from some diseased artery or distant part, and generally from the heart. The physician meets with it in cases of paralysis more or less complete, associated with valvular disease of the heart, acute rheumatism, or aortic disease, caused by a thrombus formed in an atheromatous vessel and carried forwards into a cerebral vessel; or by the plugging of a capillary by the oily or fatty *débris*, derived from the disintegration of an atheromatous patch. The Surgeon meets with it in certain forms of amaurosis and local gangrene, and as a precursor of aneurism. The pathologist sees it in the fibrinous clots (infarcta) found frequently in the lungs, spleen, kidneys, or other organs.

Examples of the arterial form.

Symptoms of arterial embolism.

The *symptoms* of embolic occlusion of an artery are sudden and severe pain in the part from which the circulation is cut off, the pain in some cases extending down the whole course of the artery; in others it is a local numbness; tenderness is usually present in the course of the vessel. Symptoms of a deficient circulation in the part soon appear, such as coldness and pallor of the skin, which may go on to complete gangrene. All cases of embolic occlusion of an artery, however, do not end in death of the part, since in patients of good power the collateral circulation may become subsequently established and a recovery follow. In patients of feeble power gangrene is to be feared. In not a few cases, embolism leads to the formation of an aneurism (*vide* page 495).

Example of gangrene due to embolism.

A woman, æt. 47, who never had any illness, was seized in June 1868, with a mild attack of hemiplegia on the left side, from which she perfectly recovered in three weeks. She remained well and returned to her ordinary duties—those of a laundress—for three months, when, whilst kneeling, she suddenly felt a severe pain in the *right* leg, extending down the calf. This was rapidly followed by numbness and coldness of the leg and discoloration. She was admitted into Guy's under my care, three days subsequently, with gangrene of the foot and lower two thirds of the leg. The pulsation in the femoral artery was normal, but no vessel could be felt below the thigh. I amputated the limb at the knee-joint on October 13th, twisting the popliteal and other arteries. Some sloughing of the stump followed, but recovery appeared probable, when acute bronchitis set in, followed by delirium and death. Dr. Fagge kindly examined the patient's heart before the operation, and reported, "There is scarcely any evidence of cardiac disease, but I think that I discover a short presystolic bruit. If this is so the mitral orifice is probably contracted, and a clot formed on the valve, or in one of the heart's cavities, may have been carried into the artery of the lower limb." After death the mitral was found the size of a button-hole. Around its edge were recent vegetations, and one of them, doubtless, had been carried into the circulation, causing the gangrene, as another had caused the paralysis three months previously.

Many cases of senile gangrene are doubtless embolic, from the washing away of some calcareous fragment from an atheromatous vessel.

In some cases of occlusion of an artery by an embolus, after the

application of a ligature, hyperæsthesia, and increased temperature of the part below the seat of obstruction may be met with. These symptoms are clearly due to the influence of the nervous system and the congestion of the smaller collateral vessels.

Hyperæsthesia of parts below the occlusion by embolus.

Dr. Wilks has also shown ('Guy's Hosp. Rep.,' 1870) that, as in phlebitis, morbid matters may be taken up by a vein and carried into the circulation through the right side of the heart, thereby giving rise to *venous pyæmia*, so disintegrated fibrin of the blood may be carried into the arterial system from the left side of the heart, and give rise to *arterial pyæmia*. Febrile symptoms with joint-pains and rigors, associated with aortic and mitral bruit, ought to excite suspicion of this latter affection; but when the liver or spleen is found enlarged the diagnosis is confirmed. He also points out how this occurs in a secondary fever of the nature of pyæmia, after scarlatina, which is often followed by joint-pains, and not unfrequently by endocarditis. In confirmation of these views I may mention that it has twice fallen to my lot, in the case of female patients, aged respectively fifteen and twenty years, to amputate a leg for gangrene, the result of occluded femoral artery after scarlet fever. In neither of these cases had any vessel to be secured, while in both a good result rapidly ensued.

Arterial pyæmia.

Pulmonary embolism remains to be considered, a form which is important to the Surgeon, not so much as a disease of the lung as because it is generally a sequence of some clotting or thrombosis, as it is called, in the veins. This clotting is very common in all kinds of cases under treatment in surgical wards. We can hardly represent the case too strongly, and we know of no more important subject than this relation of thrombosis to pulmonary embolism. Whenever a patient undergoes prolonged rest in bed, especially if he be naturally weak, bloodless, or debilitated, from any cause whatever; if the blood be over-fibrinous, as in lying-in women; whenever there is any surgical fever, and in other states too numerous to mention, there is a risk of clotting occurring in the *quiet* parts of the circulation, especially in the veins of the lower limbs and in those of the pelvis. The symptoms are often slight. If the clot be due to phlebitis, then there may be pain; if not, there may be no more than the slightest œdema about one ankle. This, however, is sufficient to put the Surgeon on his guard, and, by the subsequent enforcement of prolonged rest, time is given for the adhesion of the plug to the vein wall, and pulmonary embolism is arrested. It should be remembered, too, that clot forming in contact with a comparatively healthy vein wall, as is the case in many instances, takes time, and sometimes a very long time, before adhering to the wall, and until it does there is the risk of its detachment when the patient moves. There can be no doubt that many have died of pulmonary embolism when, with a little more vigilance on the part of the attendants, the patient might have been saved.

Pulmonary embolism.

These remarks apply to embolism of the larger branches of the pulmonary arteries, which never give rise to further changes in the lungs, and the patient dies from asphyxia. If the smaller branches, however, become plugged, then arise those secondary infarcta already mentioned, and, in the case of septic embolism, the lobular pneumonia of pyæmia and gangrene of the lung.

Pathology.—The changes which take place when an artery becomes plugged differ according to the size of the affected vessel. If it be a

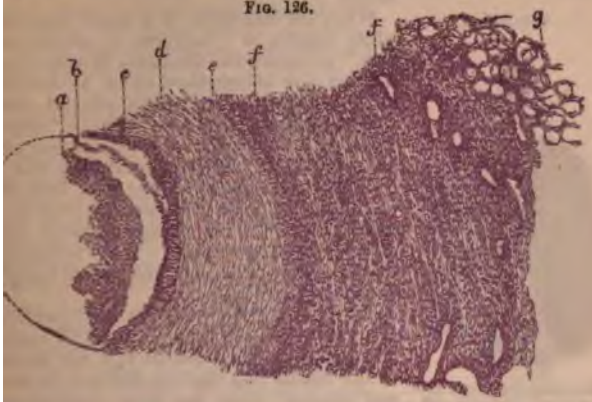
terminal vessel, the immediate result is congestion of the vascular area concerned, with subsequent hæmorrhage and atrophy of the tissue. The various stages may be studied with great precision by the ophthalmoscope in occasional cases of embolism of the arteria centralis retinæ. It is unnecessary to discuss whether the process is due to vasomotor paralysis or alteration of blood pressure, since it is of pathological rather than of surgical interest, and the questions involved are fully stated in all pathological works. We shall, therefore, only remark further that embolism of the small vessels is important or otherwise, according as the source from whence the plug is derived is healthy or not. If the clot be septic, then the resulting infection will probably lead to an abscess, and hence the probable connection of abscesses in the pelvis with those in other parts after labour, or after operations in the viscera or connective tissue of the body. But embolism of the medium size and larger arteries is followed by changes of the very greatest moment in the walls of the affected vessels. Unfortunately they have, up to the present time, not been fully worked out as regards embolism, though we can obtain considerable aid towards understanding what takes place by availing ourselves of the experiments which have been made for us by the ligature of vessels. When an artery of any size becomes closed by an embolism, the canal may of course be gradually restored by the disintegration and washing away of the plug; if not, the presence of the clot acts as an irritant, inflammation is set up, and the clot becomes adherent to the wall of the vessel. It is a disputed point whether the next stage is one of organisation and vascularisation of the clot, or of absorption of the clot by vascular granulations which spring up from the wall of the vessel. Weber holds the former, but Cornil and Ranvier the latter view. This difference, however, does not matter, as all that is important would be granted by either, viz. that embolism leads sooner or later to a local inflammation of the arterial walls. But if arteritis is thus produced by a simple and healthy clot, the intensity of the local disease will be greater when the clot is septic, the plugs so exciting the component elements of the surrounding arterial coat that its tissues will become disorganised, its cellular elements multiply rapidly, and the coats as a consequence give way. Indeed, we know that these changes do actually occur in small vessels, and abscesses follow; so, without doubt, also though the fact is less generally recognised, the same changes occur in the larger arteries, and lead occasionally to aneurism. I shall revert to this subject in the chapter on Aneurism, and will add no more here, since what has been already said, together with the subjoined woodcut of the state of the arterial coats after embolism, may sufficiently explain the morbid processes set up in the larger vessels.

Treatment.

TREATMENT.—The objects which Surgeons should have in view in the treatment of a vessel occluded by an embolus are, to favour the venous circulation through the limb by its elevation, and to establish the arterial collateral circulation by maintaining the warmth of the limb by means of cotton wool carefully wrapped round it over oiled lint. Pain can be relieved by sedatives, such as chloral or opium given by the mouth, or morphia injected subcutaneously, while the powers of the patient are to be maintained by nutritious diet, by stimulants carefully administered, and by tonics.

hen gangrene has taken place the parts may be covered with some eptic material, as carbolic acid in a watery or oily solution, one When gangrene has resulted.

FIG. 126.



verse section of the upper part of the radial artery plugged by an embolus of ptic origin some days before death. From a case of ulcerative endocarditis (boy, . 19). Drawn by Dr. J. F. Goodhart, to show the condition of the adventitia.

t.
ernal coat.
ernal elastic or fenestrated membrane.
ddle muscular coat.
e. Outer elastic membrane.
f. Adventitia crowded with abnormal nuclei, and proportionately thickened.
f Region of vasa vasorum.
g. Fat.

to thirty; or with powdered charcoal, chloralum, terebene, or Dougal's disinfecting powder; but if the odour is not very offensimple oakum surrounding the part may be sufficient.

hen the line of demarcation has formed and the gangrenous part be removed by amputation, such an operation may be performed, the Surgeon should always be cautious in interfering with these . He should at the same time take every precaution that any sary or desirable operation is not unduly postponed.

ANEURISM.

aneurism is either a "*sacculated tumour*" containing blood com- Definition.
icating with the canal of an artery, and formed more or less from its ; or a "*fusiform dilatation*" of an artery. When all the coats nvolved in the sacculated dilatation it has been the custom to des- it as being "*true*"; and when the two inner coats have given way Varieties. the external or cellular alone remains, as "*false*." I agree with nes, however, that it is impossible clinically to perceive any difice between true and false aneurisms at the time they generally under observation, inasmuch as the true become false as they , and the false are by far the more common. I hold, moreover, Moxon, that pathologically, "when an aneurism has reached size, and often before it has well started, the several coats of the l have lost by inflammation their distinctive character, and that

the sooner the division of aneurisms into varieties by the supposed behaviour of the several coats becomes purely a matter of history the better."

Fusiform.

When the distension of a vessel involves its whole calibre, a "*fusiform or tubular aneurism*" or aneurismal dilatation is said to exist, whether the enlargement be or be not due to an inflammatory disease of the arterial coats.

Fig. 127.



Sacculated traumatic aneurism. Drawing 44[18], Guy's Hosp. Mus. Mr. Poland's case.

Diffused.

What is described as a "*diffused*," *spurious, or consecutive* aneurism is where the sac of the aneurism is formed by the muscles and condensed cellular tissue of the part into which the blood has been extravasated from a ruptured aneurism or a ruptured artery—rather than by the arterial coats. These terms should not be applied to cases in which there is *diffused extravasation* of blood.

Dissecting.

"*A dissecting aneurism*" is one in which the inner is separated from the middle coat, or, where blood is extravasated into the thickness of the middle coat itself, or between the middle and external coats, the blood re-entering the cavity of the artery at some distant spot. The aorta is the part usually affected, and even its whole length may be involved. An excellent example of this affection has been recorded by Dr. Fagge ('Med.-Chir. Trans.,' vol. lii). These cases, however, rarely come under the hands of the Surgeon. There are also cirsoid and arterio-venous aneurisms to which attention will be drawn. To show what an aneurism may do, the following figure (Fig. 128) is given. It was taken from a drawing in Guy's Hospital Museum. The aneurism of the innominata has involved the left carotid and root of the subclavian, a second aneurism of the left carotid existing above.

Pathology of Aneurism.

Pathology of aneurism.

Over-action of heart.

A low form of inflammation of the arterial walls is without doubt the most common predisposing cause, while over-action of the heart and circulation is the exciting cause of aneurism. Direct injury to an artery is an occasional cause (traumatic), although more frequently the injury sets up the disease that produces the aneurism. Whenever the coats of an artery are weakened by accident, disease (suppurative or otherwise), or the loss of their natural support, they become liable to dilate under any sudden or prolonged increase in the force of the circulation. Dr. Rendle, of the Queen's Prison, Brixton, has recorded two cases in which abdominal aneurism could be traced to the shock caused by a sentence of transportation. Aneurisms are more common in the aorta, where chronic inflammatory changes are likely to appear, and the heart's action more directly felt; at the bifurcation of an artery, where the force of the circulation is always more powerful; or, at the flexure of joints, where muscular action is the most liable to tell by overstretching or bending.

That aneurism is a disease of the arterial system and not always

traumatic origin is proved from the fact that a man may have an urism form when in bed, and that the whole arterial system may involved in the disease. Broca has mentioned a case of Pelletan's, which sixty-three aneurisms were found one body. It is also a disease of middle , half the cases occurring between the ages hirty and forty-five. It is not uncommon, rever, to find it in young persons. Dr. Moore exhibited one of the external iliac ry in a child æt. 7 (Path. Soc., Oct. h, 1882). Syme has recorded an instance child of nine. My colleague, Dr. Haber- n, reported an example of femoral aneurism boy of ten with heart disease. *Cerebral* urism in early life is still more common. such cases, almost without exception, are ciated with vegetations on the valves of heart, and often with ulceration of the ves, and are probably due to embolism. e symptoms are those which Dr. Wilks described under the term "arterial py- ia," they are mainly, considerable pyrexia d enlargement of the spleen. Many such e now on record, and beside the parts above entioned, they have been found situated on e brachial, ulnar, popliteal, axillary, mesenteric, and many other naller vessels. Indeed the frequency of their occurrence can only be timated by looking into the literature of visceral aneurisms. It will n be found, that though the relation between heart disease and urism has not till of late years been studied, very many cases neurism associated with endocarditis and emboli in the solid ra have been recorded at different times. Among the earliest rs on the subject are Joliffe Tufnell in the 'Dublin Journal,' , p. 371; Dr. Ogle, 'Path. Trans.,' vol. viii; Dr. Wilks, do., ; Mr. Holmes, do., vol. xii. Other cases have been recorded in the 'Transactions' more recently by Drs. Church, Goodhart, Gowers, son, Semple, and myself. Similar cases may also be found in medical publications, *vide* 'Bright's Medical Reports,' vol ii, Gull, 'Guy's Hosp. Rep.,' 3rd series, vol. v, p. 299; Ponfick, Archives,' Bd. 58, 1873. See also Wilks and Moxon, 'Path. p. 158-9; Holmes, 'Syst. Surg.,' &c.

FIG. 128.



Drawing 42⁴⁸, Guy's Hosp. Mus.

Aneurism children.

Aneurism due to embolism.

ns explanations have been given of the occurrence of aneurism ch conditions. It has been maintained by some that the plug sudden obstruction and afterwards to dilatation of the vessel t. But a look at preparations of such aneurisms shows, that ation is not behind the embolus, but actually at the plugged oreover, if the local obstruction leads to dilatation behind it, to find aneurism a more common result of ligature than is we ought to find it more frequently after embolism than we e embolism is a very common affection in one part or another ly. Other ingenious, though somewhat laboured, explana- been offered, which need not be mentioned here, and the of any importance is that recently ably argued by Dr.

Aneurism from embolism.

Embolism inducing local arteritis.

Goodhart, attributing the aneurism to a local arteritis, which in its turn has been caused by the embolism. It has been already asserted that when an artery becomes blocked, the clot, unless it softens and breaks down, becomes adherent to the wall, and subsequently becomes vascular. If this be true, and that it is so is allowed by nearly all observers, then there must have been some preceding inflammation of the wall of the vessel to allow of this new formation of capillaries. That embolism causes a local arteritis is admitted, but how it is that under these circumstances, an aneurism is so rare a result has yet to be explained, and the explanation is probably to be found in an examination of the cases in which emboli exist. They are almost without exception examples of ulcerative endocarditis, in which there is a very severe local inflammation attended with symptoms of blood poisoning, which is supposed, and we think rightly so, to be due to the septic nature of the emboli which are detached from the ulcer and carried to all parts of the body. When this septic clot becomes lodged in some part of an artery, in proportion to its septicity the artery will inflame, and as a consequence in the more severe cases there will be the rapid formation of an abscess and perhaps a false aneurism; whilst in those somewhat less severe cases, there will be acute softening and cellular infiltration of the arterial coats, with probably the formation of a true aneurism. In the majority of cases, however, as the embolism is not caused by septic clots, there will be neither aneurism nor abscess.

In June, 1883, through the kindness of my colleague Dr. Pye-Smith, I saw a man, æt. 25, who had been admitted under his care at Guy's with heart disease, and symptoms of embolism of the spleen, kidney, and right brachial artery at its bifurcation. The arterial obstruction had taken place the day before his admission, when he was at work, with sudden severe throbbing pain in the bend of the elbow, soon followed by swelling. On admission there was a local swelling at the point corresponding to the bifurcation of the vessel, pulsation in the brachial artery down to this spot, but not at it, no pulsation in the right ulnar artery, and very feeble pulsation in the radial. On the second day a hard lump was felt at the bifurcation of the brachial. On the fourth day the pulsation in the lower vessels had improved. On the sixth the collateral vessels about the elbow were enlarged. On thirtieth day, where the lump had been at the bifurcation of the brachial artery strong pulsation was felt. On the thirty-fourth day an aneurismal sac was clearly to be felt, with a marked bruit over it. On the forty-sixth it was as large as a nut. The pulsations in the radicle ulnar arteries were full. In this case the whole course of events may be said to have been under observation, and the fact of the formation of an aneurism following an embolism was clearly demonstrated.

Progress and Natural Cure of Aneurism.

Progress of aneurism.

An aneurism when once formed has a natural tendency to increase, the "sacculated" more so than the "fusiform," and the "sacculated" communicating by a small opening with the cavity of an artery has a tendency to increase more rapidly than another in which the opening is free—the force of the circulation being more concentrated upon one point of the aneurismal sac in the former case than in the latter

ence sacculated aneurisms attain a much larger size than the fusi-
rm, and are much more liable to rupture.

When an aneurism is cured, it is so by its cavity becoming filled
ith blood clot, which subsequently contracts; and in the best cases,
the occlusion of the arterial trunk upon which the aneurism is
aced: the sacculated aneurism is more capable of a natural cure
an the fusiform. When the arterial
ats are roughened by disease and weak-
ed, the fusiform is as likely to in-
ease as the sacculated, and is as capable
a spontaneous cure. In any case of
eculated aneurism, as well as in some
fusiform, a *spontaneous cure* may take
ace by the coagulation of the blood in
e sac and the subsequent consolidation
the clot. When this process is slow,
e fibrin of the blood is deposited in
yers or laminæ (Fig. 129); the external
yer in contact with the walls of the
c becomes at times more or less united
th them, and so strengthens them as
prevent their dilatation; the clot also
comes dense by contraction and decolo-
ed. Subsequent layers form in the same
nner as the process of recovery pro-
ds, until the whole sac is filled and finally
literated. A section of an aneurismal
thus cured much resembles that of an onion, the outer laminæ
fibrin being thin, fibrous, firm, and bloodless, each successive layer
ards the centre approaching more to the colour and consistency
ewly coagulated blood. The laminated coagulum lining the sac
equently called after Broca "active clot," and the soft coagulum
e centre "passive clot," from the idea that this latter is a
post-mortem and not a vital deposit. This view, however, can
ly be correct, as there can be little doubt that in all cases of
sm that are rapidly cured by pressure, digital or otherwise,
nsolidation of the aneurism must be due to the simple coagu-
of the blood in the sac, and its subsequent induration and con-
, inasmuch as a few hours are evidently too short a period for the
m to form in any other way. In the following beautiful drawing
0) by Dr. Moxon, taken from a specimen of popliteal aneurism
as cured, in a man under my care two years before death, by
ompression applied for four and a half hours (*vide* 'Guy's
p.,' 1869), the whole pathology of aneurism is shown, with the
tion of the aneurism and occlusion of its supplying artery.
of Dublin, and some older pathologists, believed that the
ch lines the sac was the product of an exudation from the
mbrane of the sac, and that successive exudation of this
ormed the laminæ. This view, however, is now almost
Le Fort also accounts for the cure of the fusiform aneurism
ation of the inner lining of the sac, and he regards the
simple dilatation, which it is not in all cases. Most patho-
ver, now admit, that where the inner tunic of an artery

FIG. 129.



Laminated coagulum removed from axillary aneurism twelve years after Mr. Key had ligatured the subclavian artery. Operation performed, 1823. The coagulum had no attachments to the sac. Prep. Guy's Hosp. Mus., 1499[64].

Spontaneous cure.

Appearances of a cured aneurism.

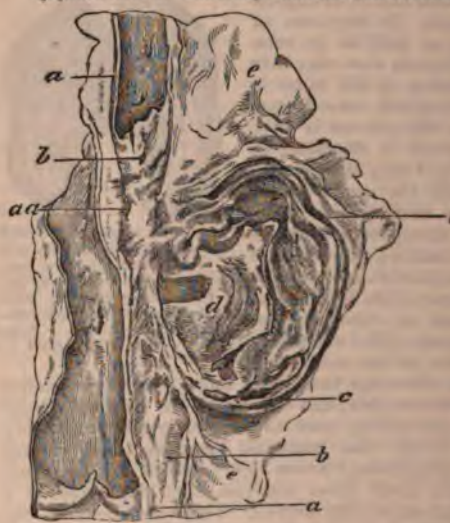
Consolidation due to coagulation of blood in sac.

Colles' view.

exists in a healthy state in an aneurism, coagulation of t
does *not* take place within the sac, and consequently that a spo
cure is impossible, and that in the sacculated or fusiform aneur
cessive deposits of fibrinous laminæ only take place when the
membrane is absent, from the contact of the blood with th
walls of the sac.

FIG. 130.

Section through an aneurism of the popliteal artery, cured nearly two years
digital pressure. The aneurism is not dissected out, but left embedd
popliteal fat, *e*, *e*. The artery is occluded with the aneurism.



a. The sectio
the arterial co
healthy.

a, *a*. The co
diseased and
part of the arte
substance is
and blended
new fibrous
which fills th
yet not so much
but that they
be traced to th
of the aneurism
the upper *c*).

c. The aneu
composed of
clot and congr
sue welded tog
definitely.

d. Scarcely
clot, filling the
the sac.

The vein,
valves in its in
is seen close to
artery.

Mr. Poland has recorded a case, probably unique, occurring
practice of Dr. Adams, of Dublin, of fusiform aneurism of t
clavian, which tends to support this theory. ('Med.-Chir. Trans.,
1869.)

Cure of aneurism by distal occlusion.

An aneurism may also be cured by the "distal occlusion" or p
of the artery beyond the sac with a clot that has been dislo
the force of the circulation, accident, or design. The vessel
may be only partially closed by the clot, yet fresh fibrin will
deposited upon the "embolic plug," and complete obstruction
duced. This natural mode of cure is utilised in the distal o
for the cure of aneurism, and in the cure by manipulation.

Cure by sloughing of sac.

may also be caused by the "sloughing of the tumour" (suggre
treatment by caustics). It is likewise on record that the art
which the aneurism is connected may be obstructed either
below the sac by the pressure of the aneurism itself from

Pressure of sac on artery.

bound down by a strong fascia, or from the pressure caused b
blood following its rupture; and, in the treatment by flex
natural mode of cure is made use of. As an aneurism

n the neighbouring parts, tissues are separated and one may even be gradually worn away by the steady ulsating tumour, so that in thoracic aneurism the erforated or the bodies of the vertebræ eaten away, canal opened (Prep. 1489[30], Guy's Hosp. Mus.). ease the tissues surrounding the sac may inflame, ly suppurate, and, by becoming condensed, give the pport and tend to retard its growth. In rare cases action may involve the sac itself and cause slough- the aneurism increases unchecked it will eventually racic or abdominal aneurism may burst into a mucous trachea, pharynx, œsophagus, or intestine, and, when ner ('Med.-Chir. Trans.,' vol xlii) has shown that it ecurrent hæmorrhage through a *small* orifice. When rous cavity, such as the pleura, pericardium, or perito- by a sudden hæmorrhage through a *large* aperture. record where it discharged itself into a vein or the . External or surgical aneurisms burst by the for- g way of a slough. Aneurisms of the extremities or may give way into a joint or cellular tissue. It may ut only in rare instances. An aneurism may be fairly d yet increase, the blood making its way round the lating its walls. This is prevented only when the with the sac as well as the aneurism is filled with

Mode of extension of an aneurism

Termination of aneurism.

owever, has more to do with external than internal hough the pathology of both forms is alike, the treat- is to surgical aneurisms, therefore, that the following cially apply, and first of all as to their symptoms

On external aneurism.

Symptoms and Diagnosis.

has no pathognomonic symptoms, and its early ry uncertain. It often happens that the patient's directed to some *swelling;* although it may be *l throbbing*—some weakness or stiffness of an ex- *nerve pain* preceding the discovery of the disease; yet e not constant. When, however, the Surgeon is con- at shoots down the course of a nerve running in con- artery, he should allow the thought of aneurismal through his mind, and, when this is associated with tumour connected with the vessel, the suspicion of its should be excited. If this tumour be *soft, expansile,* it become tense on the application of pressure to the ry on the distal side, and flaccid, non-pulsatile, and sure on the cardiac side, and, should pressure on the e pulse in the vessel below, the chances of its being t almost to certainty. Should it expand again readily f the pressure, and this expansion be accompanied hrill on the re-admission of blood into the sac, with r or aneurismal bruit, synchronous with the pulse, application of the ear to the tumour, the diagnosis

Symptoms.

Diagnosis.

Pain.

Pulsating tumour.

Expansion of tumour.

Bruit.

State of pulse on affected side.

The pulse of the extremity below the swelling is general it is weaker and slower than its fellow, and, as the disease it may cease altogether. The blood will then flow in stream" or cease to flow either from the obstruction of trunk by the pressure of the aneurism, or the embolic occlu vessel below from a dislodged coagulum. Under these cir fulness of the veins with œdema of the parts supplied b will soon appear, and, at times, excruciating pain from st

Pressure on nerves, &c.

the nerves will arise. If the aneurism be cervical and the through the brain be interfered with, giddiness and loss o ness may be present, and, where any pressure is made upo rent laryngeal nerve, a peculiar and characteristic hoarse produced. This hoarseness is sometimes associated with l and laryngeal spasms simulating laryngeal disease. In a woman, æt. 22, under my care, in whom an aneurism existe the aorta below the opening of the left subclavian and pr the left bronchus and trachea, this symptom was so severe for tracheotomy. When the cervical sympathetic ganglia upon, the pupil of the affected side may be permanently and nerve pains will be present according to the amount applied.

Difficulties attending diagnosis.

When an aneurism has partially consolidated, and has enlarged, or become so diffused as to press upon the soft p no longer to exhibit any pulsation—for there are aneurism not pulsate; when it feels firm, with possibly a soft point there, some difficulty may be felt in forming a diagnosis Surgeon, under these circumstances, will have to depend upon the history of the case as upon the physical symptom external signs of inflammation or suppuration are present, the will be enhanced, for it must be recorded, that aneurisms ha

Mistaken for abscess.

circumstances have been opened for abscesses. I remember a aneurism having been so maltreated with a fatal result. S takes of diagnosis, however, ought not to occur, as they ar carelessness. The diagnosis of an aneurism may generally be attending to the history of the case and to the existing symp

Abscess over artery.

abscess in contact with an artery may receive pulsation fr may any cyst or even solid tumour, but in all these the pul cease on the application of pressure to the artery above the without any change whatever taking place in the tumour have seen a case of lumbar abscess which pulsated freely fr contact. It is also rare for such tumours to cause a bru

Abscess ulcerating into artery.

are on record in which an artery in contact with an abscess rating hydatid cyst has been opened by ulceration, and given idea of an aneurism. Pulsatile tumours of bone may al

Pulsatile tumour of bone.

taken for aneurism; but from the former being in bone an less ossific; from the bone being expanded, although partic larly; and from a bruit rarely existing in it, the diagnosis to be difficult. Tumours lying near large arteries and pulsation from them, may likewise be mistaken for aneurism the pulsation not being expansile and the tumour being being drawn away from the vessel a correct diagnosis should It must be admitted, notwithstanding, that men of the gr and experience have mistaken such cases for aneurism.

Treatment.

Treatment of aneurism.

re is probably no disease a Surgeon has to treat which requires dealt with more on scientific principles than aneurism, since all nent to be effective must be based upon the physiological pro- of a natural cure; and this natural cure is brought about by the lation and subsequent consolidation of the blood in the aneurismal and in the best examples in the artery upon which the sac ced, *vide* Fig. 130.

Natural process of cure.

induce coagulation of the blood in the sac and artery by natural esses becomes consequently the chief object of treatment, and is to be brought about by general as well as local means. this purpose it is necessary to have a feeble circulation through sac; and to this end, *rest in the recumbent position is an essen- point to be observed*, and it ought to be maintained in every case; ed, there is every reason to believe, that by it alone, aneurisms e been cured. Luke ('Lond. Med. Gaz.,' May, 1845), Belling- n, Tufnell, Stanley ('Path. Soc. Trans.,' vol. v, p. 107), and others, e recorded instances of this nature. Tufnell allowing for diet ut ten ounces of solid and eight ounces of fluid food in the twenty- r hours. *As a preliminary to all other treatment, "absolute rest" therefore, most essential.*

Induce coagulation in sac.

Rest.

Venesection and Valsalva's treatment.

With the same object "bleeding" has been employed, and was at time largely practised on the authority of Valsalva, who powerfully ocated it, and probably to excess. There seems no reason why it ld not be adopted when the force of the circulation is strong and powers of the patient are good; as bleeding not only lowers the e of the circulation, but at the same time tends to render the blood e fibrinous. In internal aneurism it is calculated to be of more ice than in external, but practised with caution, it is doubtless of e in both. Medicines do not seem to have much influence in en- aging the coagulating process, though the acetate of lead gave promise of value in the hands of my former colleague, Dr. G. O. , but more extended experience has not confirmed the hope held the iodide of potassium or sodium has been also much vaunted, particularly when syphilis is suspected. *Nutritious* but *un- ulating* food should be given in all instances to maintain the ers of the patient, though not to increase the force of the circula- All mental excitement should be positively forbidden.

Acetate of lead.

Diet.

Local treatment.

he object of the local treatment of aneurism is to arrest or diminish circulation through the sac; and the success which is to be ex- ed from whatever practice may be adopted, will depend as much n the shape of the aneurism as upon the size and position of the ing into the sac. The Surgeon has for this purpose a variety of ns at his disposal, which may be divided as follows:—

The principles.

Means at Surgeon's disposal.

Compression of the artery above the aneurism—"indirect pres- ."

Compression of the aneurism itself—"direct pressure."

Compression of the artery as it leaves the aneurism—"distal sure."

The Hunterian operation of applying a ligature to the artery on cardiac side of the aneurism, or the occlusion of the afferent vessels ther means.

5. The application of a ligature to the artery within t itself—operation of Antyllus.

6. The application of a ligature to the artery on the d the aneurism—"distal operation."

There are likewise other means which may be justifiably exceptional cases, such as the treatment by manipulatio puncture, and the introduction of some foreign body into

Guy's statistics.

which attention will be drawn. At Guy's Hospital in years ending 1880, 42 aneurisms were treated by compre and 19 by the Hunterian operation when compression had 13 cases the Hunterian operation was primarily employed operation of Antyllus was performed. In 3 the distal l used. In 1 primary amputation was called for, and in 1 rismal sac was plugged with horsehair. In all 82 cases w For full details *vide* valuable paper by Charles Symonds ('G vol. xxv, 1881, p. 447).

Treatment by Compression.

Indirect compression.

1. **Indirect Pressure.**—This plan of treatment, to which "Dublin Method" may be fairly given, has now found a las in surgery; Todd, Hutton, Bellingham, Tufnell, and Carte, t originating the practice, having adduced ample evidence of its and practical value. It consists essentially in the more or less

Mode of action.

cutting off the supply of blood from the aneurismal sac by the tion of pressure to the artery on its cardiac side: and the m pletely the current of the blood is arrested, the more rapid a be the cure; modern experience having fairly proved the sou Dr. W. Murray's observation in 1871, that the principle on w rapid method rests is clearly "the complete stagnation of a blood in the aneurism until it coagulates. Whether this done under the influence of an anæsthetic or without; whether sure both above and below, or only above the sac; and whether sure is to be made by the hand, by flexion, by a weight, or by a tou are questions which in no way touches the principle on which th ment is based. The practice is theoretically sound and practica and is capable by itself of curing the majority of surgical an and even some that are internal. At least four cases of aneu

Digital pressure when practicable.

the neck have been cured by digital compression of the carotid, and M. Rouge, of Lausanne, reports a fifth, in which æt. 68, had a carotid aneurism cured in seventeen days by pressure between the thumb, in front of the sterno-mastoid mus the fingers behind ('Bull. de la Soc. de Chir.,' 1868, p. 464). has also apparently cured a sixth case by the same process ('L Holmes' Lect., 1873).

When unadvisable.

Compression should not be attempted where evidence exists sure upon the main vein of the limb, as indicated by œdema; w the aneurism is rapidly increasing, or a rupture of the aneurism imminent, because in such cases a ligature should be applied arterial trunk. It should not be persevered with when sloughing skin has been induced; nor ought it when, from some constit irritability, indocility, or stupidity, the patient fails to second t geon's aim; for to make the patient understand the objects wh Surgeon has in view is doubtless a valuable means of guarantee

ful accomplishment. It must be known, however, that when ession has failed to cure, "the patient is in a worse and not a state for subsequent operation." Mr. Holmes has demonstrated ct ('Lancet,' Oct. 12th, 1874).

treatment can be carried out by "digital" or "instrumental" ession, or by means of "Esmarch's bandage," a form of pressure differs from the other in some essential points, to which attention drawn.

igital pressure" to be successful must be well applied; when rently carried out, it is probably less to be relied upon than mental pressure. To keep up a steady pressure upon the trunk artery for any time consecutively, is a difficult task; and few ould do it for more than ten minutes. What is wanted is the steady pressure of a finger or thumb applied directly over the vessel is to be compressed, such pressure being so adjusted as to be ent to arrest the flow of blood through the artery, but no more. ter pressure than this is a waste of power on the part of the Sur- and a cause of needless distress to the patient. Neither vein nor e need be much pressed upon as a rule, nor much pain produced. arry out this treatment three good men should be employed for or five hours consecutively, each in rotation carefully applying ure for ten minutes at a time. By adopting this practice I have d an aneurism of the thigh in twenty-four hours, and in other even less time has sufficed. In a case I recorded in 'Guy's . Rep.' for 1869, a patient, æt. 32, cured himself of a popliteal ism by pressure in four and a half hours. In one more recent a æt. 40, cured himself in eighteen hours, after flexion and pro- l surgical treatment by instrumental pressure had utterly failed. nzetti, in 1855, records a case, in which digital compression popliteal aneurism in four hours.

n digital pressure can be employed and is successful, it is more han any other, and as a rule less painful. It can also be used strumental pressure is inapplicable, as in the case of the carotid. when admissible, it should always be primarily employed in pre- o any other form of treatment.

rumental compression."—When digital compression cannot d, the next best is instrumental pressure, and for this purpose othing equal to a conical weight of lead (Fig. 131A) covered her and perforated with an iron axle (B), upon which extra ead (C) can be dropped (Bellingham's method); the weights djusted as to arrest the circulation through the artery, re. This weight can be slung to a cradle placed over the by an assistant, or left to the intelligent patient. It can be tly from one spot to another when pressure causes pain, and inful than any other instrument. In popliteal aneurism ay be adjusted to the upper part of the groin, and it is an n to apply a semicircular tourniquet lower down, by which re can be applied alternately. The instruments of Signo- am (Fig. 131 D), Skey, Crampton, Carte, or any other e pad to press upon the vessel, and not otherwise inter- irculation through the limb, may be used for this purpose. nsist of a circle or semicircle of steel, a fixed pad being e side for counter-pressure, and a moveable pad, adjusted

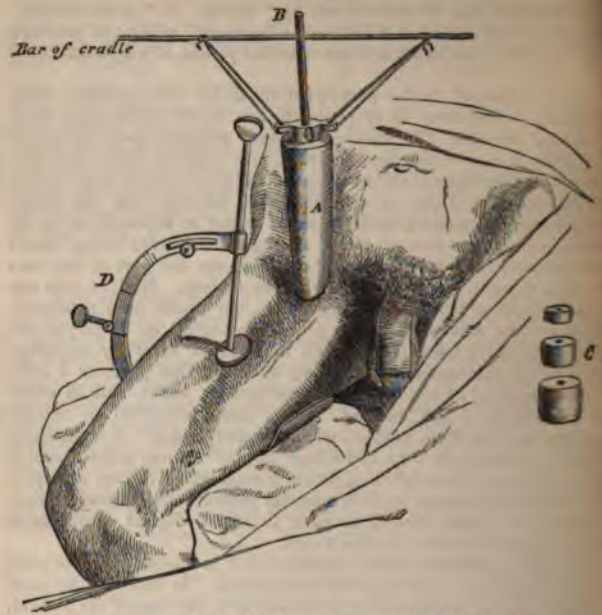
Ou mode applicatio digital pressure.

Examples.

Instrumental pressure. Use of weight.

by a screw, for direct pressure. Indeed, with these instruments carefully adjusted by the aid of a trustworthy assistant who will see that

Fig. 131.



Mode of applying pressure to the femoral artery for the cure of aneurism.

Fig. 132.



Weiss's double pad.

pressure is well applied, maintained, and shifted only when required, most cases of aneurism of an extremity may be treated. In Fig. 132 is depicted an ingenious contrivance made by Weiss, on the principle suggested by Mr. F. Bulley, for the application of pressure to an artery by means of pads which may be used alternately, and adapted to Bellingham's instrument (D, Fig. 131), either by the rigid screw or elastic pressure of Coles' pad; and in Fig. 13 is shown a very valuable arrangement suggested by Mr. George C. Coles—the pressure being elastic—which may be used as hand pressure or adapted to any of the tourniquets. The treatment by compression requires intelligent supervision, and then is very successful; but without such, it is uncertain in its effects.

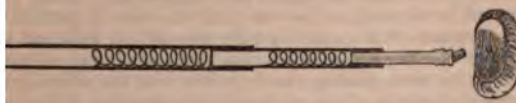
My friend and colleague, Mr. Davies-Colley, who happened to have been my dresser when

iteal aneurism was under treatment by digital compression, e that he proved by experiment that he could readily arrest ion through the femoral artery for six or eight hours at a is finger applied directly over the vessel, and the weight n his finger, the weight acting in lieu of the muscular power otherwise have been required as the compressing force.

alise the effects of the local irritation of the skin by the

Points to be attended to in using pressure.

Fig. 133.



nt consists of a trephine handle, to which is attached a straight rod ally arranged. The two upper segments of this rod are hollow tubes, aining a spiral spring; the lower segment is a solid brass rod fitting into , having at its extremity a screw at an obtuse angle. To the end of this a osed of cotton-wool and horsehair, is adjusted.

ree use may be made of French chalk, starch, or violet o allay pain, opiates or chloral in full doses may be given, ne cases even chloroform may be used and its influence r several hours, to allow of complete compression being Dr. Mapother did this for twelve hours. There seems that, in a general way, complete obstruction to the is more likely to be followed by a rapid cure than is incom- that next to completely stopping the flow of blood till the as consolidated, the application of the intermittent com- ressing force is to be advocated, or, in other words, complete may be maintained for a certain time, and then given up ned to as soon as the condition of the patient will permit. uppression of the circulation is doubtless the most rapid ring an aneurism; but the partial suppression is likewise although slower. On all these points, however, I should ublin surgeons to speak. Dr. Rawdon Macnamara has an able paper ('Brit. Med. Journ.,' Aug. 19, 1871), the following extract has been taken. It epitomises the

On complete and incomplete obstruction of the artery.

of popliteal aneurism presents itself for treatment. We o use compression. We first carefully ascertain the condition ent's general health. If anæmic or hyperæmic, we take measures; and, when we are satisfied upon this point, we one or other of the most improved compressors—those in ompressing power is modified elasticity. With this we com- rtery in the upper portion of its course, having previously me three or four inches lower down, the auxilliary instrument f which we propose to alternate the pressure. The upper is now made to control the artery, so as but just to arrest

Macnamara on the partial suppression of the circulation.

the pulsation in the sac. This is the most delicate step in all the procedure, and is regulated by the hand of an intelligent assistant, who at once informs us when the pulsation is arrested; and then and there the further application of pressure is arrested. A roster of intelligent students is now organised, and to them is entrusted the management of the case. Two are appointed to take charge of the patient for one hour, when they are relieved by two others, and so on during the day, whereby we secure unwearied attention during the period that pressure is kept up; and, as in Dublin we visit our hospital at nine o'clock a.m., the treatment generally commences about that hour, and is continued up to nine o'clock p.m., when all pressure is removed, and the patient is encouraged to take his night's rest undisturbed. Next morning the treatment is resumed, and so on until the cure is perfected. At the commencement of the case we take the patient into our confidence; explain to him the nature of his case, and the method we are about to adopt for his cure, placing clearly before him the alternative, with all its possible dangers, which we should have to adopt in case compression should fail. The value of this precedure is very frequently demonstrated by the intelligent interest exhibited by our patients in the management of their own cases, so intelligent as in protracted cases to supplement, if not altogether to supersede, the supervision of them by our students. In the selection of our compressing force we adopt in its widest sense the maxim 'Nullius addictus jurare in verba magistri.' Should one compressor prove irksome, we try another; if all should fail, we have recourse to digital compression, or to compression by means of weights; but in every instance, convinced of the soundness of this plan of treatment, we leave no stone unturned to secure its success.

The rapid treatment of aneurism by Esmarch's bandage.

Compression by "the elastic bandage" of Esmarch.—The treatment of an aneurism by this method differs from all other forms of treatment by compression, in that in it, the blood is totally arrested in all the vessels of the extremity to which it is applied, and not in the main artery alone as in other forms of compression. Under such circumstances the method has its own dangers in addition to those it shares with others, and the chief I believe to be gangrene due apparently to the clotting of the blood in the collateral vessels of the limb upon which its vitality depends. The following case illustrates the point.

Case.

The case was that of a man, æt. 45, who was admitted into Guy's, under my care, in March, 1877, with a popliteal aneurism, which was increasing so rapidly that active treatment was called for. The man could bear neither digital nor instrumental pressure upon the afferent artery. I consequently applied the elastic bandage to the limb below the aneurism, using moderate pressure, allowed the aneurism to fill with blood, and then so compressed the thigh above the sac as to entirely check all pulsation in it, these three being apparently the essential points to observe. A subcutaneous injection of morphia was also given. The pressure was maintained for three hours consecutively and a second dose of morphia injected, but when the bandage was removed the aneurism was decidedly harder, although pulsation still existed in it. Four days later all clot seemed to have disappeared, and as the aneurism was as big as ever, the elastic bandage was again applied, only on this occasion, to soothe the man, an anæsthetic was used. This treatment was continued on this occasion for three hours, and at the end, little had been gained from it. A fortnight was then allowed to

se to allow the parts thoroughly to recover themselves, when a olised catgut ligature was applied to the artery, and within one k this wound had completely healed by immediate union, not a drop us having been exuded, indeed the patient had no idea that any ration had been performed upon his thigh.

he foot, however, soon became the seat of anæmic gangrene, and rtnight after the application of the ligature amputation in the dle of the leg was required, and a good recovery followed. At the utation every arterial trunk was found obstructed. No vessel ired torsion or ligature.

n this case I am disposed to attribute the gangrene to the em- ment of the elastic bandage, and fear that from its two applications collateral vessels that would have carried on the circulation ugh the foot after the ligature of the femoral, had become blocked, as a consequence, gangrene followed.

his plan of treatment was first suggested and carried out by Staff Sur- n W. Reid, R.N. ('Lancet,' 1875), and it has since been practised in e than seventy cases. I have employed it in three. Mr. Pearce ld, an able assistant surgeon of the Middlesex Hospital, has in an resting paper tabulated 72 examples, 35 of which or half the cases e cured. In 2 the treatment was doubtful; in 20 a cure followed ligature of the artery; 3 were cured by compression and one spon- ously, and one (of bracheal artery) by the introduction of catgut the sac. In three the artery was ligatured without success; death took place whilst under treatment, and in one the limb was utated with a fatal result. Of the whole number of 72 cases— ting the three of which no subsequent history was known after the re of the method and the 2 doubtful—6 died, 35 were cured, and were successfully treated by other means after the failure of arch's bandage, in my own case after amputation—a result h is certainly encouraging. The method is most applicable nall sacculated aneurisms in fairly healthy subjects, and ought to be practised when the aneurism seems thin and likely to rup- and when by pressure it materially interferes with the venous lation of the limb.

Care during process of cure.

'Trans. of Internat. Congress,' 1881, vol. ii, p. 209.

hen employed the bandage should be so applied as to secure com- blood stasis in the aneurismal sac and its adjacent artery, and stasis should not in the majority of cases be maintained for more one hour, or for more than two in any. The bandage should arily be applied below the aneurism with sufficient firmness to t the circulation through the limb. It should be passed lightly the aneurism, so as to support but not compress it, and when ed fairly above the tumour which should be allowed to become filled with blood, it should so constrict the limb above as to nt anything like a circulation being carried out. In irritable cts a subcutaneous injection of morphia should be given before reatment is commenced, and in others an anæsthetic may be used. n the sac appears to have been filled with clot and pulsation in it ceased, it is wise to have digital or instrumental pressure kept up the afferent artery for ten or twelve hours, and even when a tful cure has taken place, a like treatment may bring about a result. Indeed in all cases of rapid cure of aneurism by this or modes of compression this treatment should be pursued, because

How to be applied.

the clot that has filled the sac must of necessity be soft, and a very little may cause its displacement, and thus interfere with that natural contraction of the fibrin of the blood that is to fill the sac permanently, prevent its dilatation, and cure the disease. At Guy's Hospital, out of 17 cases of popliteal aneurism consecutively treated by pressure, 11 were cured, and Mr. Holmes informed us in his college lectures, that out of 124 cases so treated in different hospitals, 66 were treated with and 58 without success. Of the latter, in 44, the femoral artery was afterwards tied, and in 8 amputation was practised, 5 dying. Death occurred in one case; and in 4 there was no evidence of subsequent treatment. ('Lancet,' December 19th, 1874.) In the majority of these cases, instrumental pressure was employed, and in some, the treatment was imperfectly carried out.

On direct compression.

Flexion of limb.

2. Treatment by direct pressure.—The treatment of aneurism by *direct compression* next claims attention, and in modern times it is known as that by *flexion;* for there can be little doubt that the *modus operandi* of flexion in the cure of aneurism is mainly due to three conditions, *first*, to *direct* compression of the aneurismal tumour itself; *secondly*, to indirect compression through the medium of the tumour, intercepting either wholly or partially the supply of blood to the sac; and, *thirdly*, to displacement of the clot, as suggested by Holmes, and the consequent obliteration of the mouth of the aneurismal tumour. This mouth may likewise be so situated as to be closed by the bending of the artery—an aneurism in the posterior wall of the popliteal artery being in a far more favourable position for cure than one on the anterior. At the same time we know that forced flexion of a limb is capable of arresting the flow of blood through the healthy artery. In England, Mr. E. Hart demonstrated the success of this method of treatment in the year 1858, although in 1857, Dr. Maunoir, of Geneva, recorded the first successful case in 'L'Echo Médicale' (Neufchatel), and, since that time, many surgeons have successfully applied the practice. To carry it out, the limb must be carefully bandaged from below upwards to the aneurism, and in the case of the popliteal artery the knee should be bent, sufficient force being employed to diminish or arrest the pulsation of the tumour but no more, some turns of the roller maintaining the limb in this position. The thigh should then be flexed upon the pelvis and the patient turned on his side with the limb resting on a pillow. By this plan the arrest of the circulation through the aneurism may generally be effected, and a cure expected. When the flexion is forced, the patient is too often unable to endure the suffering caused by the position. To large and rapidly growing aneurisms this method is inapplicable, and probably dangerous, as it may induce rupture; and when any inflammation or other complication exists it ought not to be employed; nor ought it be persisted in when it is not obviously doing good. The plan, however, in small aneurisms is so simple, and, when bearable, is so successful, that it should always be attempted where it can be applied, and, when unsuccessful, it is almost harmless.

'Med.-Chir. Trans.,' vol. xlii.

'Proceedings,' vol. iv.

Mode of conducting genu-flexion.

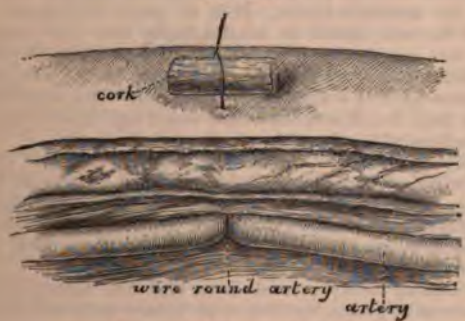
Flexion and compression.

Pressure may likewise be used with flexion where the latter is insufficient, many cases having been reported in which success followed the conjoint means. In one under my care in 1871 I cured an aneurism below the popliteal space in eighteen hours, by alternating the flexion of the leg with digital pressure in the groin.

M. Liégois, in an interesting paper ('L'Union Méd.,' Aug., 1869), gives eleven cases in which flexion alone proved successful in popliteal aneurism, and also eleven in which it was successful in combination with other measures. In four it succeeded after other means had failed. On the other hand it failed in twenty-three cases, or nearly half the whole number, and of these, seven are stated to have suffered rupture, and one had inflammation of the sac. Holmes's statistics show nearly the same results.

3. **Distal pressure.**—The compression of an artery on the distal side of an aneurism for purposes of cure claims a notice as a resource open to the Surgeon when all others are inapplicable, since there is enough evidence to show that by such means an aneurism may be cured. In my own practice, in 1872, I treated a case of abdominal aneurism on this principle, and kept up pressure for sixteen hours; and although the patient died from peritonitis, brought on by the pressure, the condition of the sac filled with clot was enough to prove the possibility of a cure being brought about. In the 'Transactions' of the Royal Med. and Chir. Society, vol. lv, the case is published in detail, with some remarks on distal treatment, which need not be repeated in these pages, although it may be stated from my own cases; from Edwards's case of the innominate ('Lancet,' January 9th, 1858); from Porter's ('Dublin Quart. Journal,' Nov., 1867), and others, that the distal treatment of aneurism by compression or ligature, whereby the efferent artery of an aneurism can be obstructed, claims the Surgeon's close attention when other means are inapplicable.

FIG. 134.



Dix's mode of compressing artery.

Dix's wire compress.

Temporary occlusion of artery.—*The wire compress of Mr. Dix*, of Hull, already alluded to (see p. 479), requires naming as a means of dealing with aneurism. It is a method that has been advocated by Porter, of Dublin ('Dub. Quart. Journ.,' Nov., 1867), Hilliard, and others (*vide* Mr. Dix's paper in the 'British Medical Journ.,' Oct. 30th, 1875, p. 551). It is in reality treatment by compression, and not by strangulation. It does not cut the artery, nor obliterate it at the seat of operation; therefore in principle and *methodus medendi* it ranks not with the ligature, but with the tourniquet and other modes of pressure. But forasmuch as the application of the wire requires exposure of the

artery by a cutting operation, this process cannot enter into surgical competition, with the simpler methods of compression and flexion, yet where these have failed or are inapplicable and operative procedure is inevitable, "then," says the author, "I back my operation for certainty, rapidity, and safety, against any form of ligature—silk, hemp, or catgut—or against any kind of forceps, 'artery constrictor,' or compressor applied in or through a wound."

The operation is as follows, and it seems to be specially necessary to follow out the exact details with care and attention:

How applied. The artery is exposed by incision and the aneurism-needle passed in the usual way. A piece of surgical wire, about nine inches long, is threaded through the eye of the aneurism-needle, and carried beneath the artery by the withdrawal of the needle, which is then separated from the wire. A straight surgical needle is then attached to either end of the wire and the two needles (first one and then the other) are passed through the tissues to the surface, so that they emerge on the skin, one about a quarter of an inch and the other three quarters of an inch from the edge of the wound, on whichever side of it may seem most convenient, *but both on the same side* (Fig. 134). By drawing them through together the wire forms a loop over the artery and the intervening tissues, and the needles are then detached from the wire. The half of a vial cork, flat side downwards, is now placed on the skin between the ends of the protruding wire, and firmly pressed down by the fingers of an assistant *in the exact line of the artery*, the wire being at the same time drawn tightly upwards and sharply twisted over the cork, till the current through the artery is effectually stopped and the pulsation of the aneurism ceases. It is of great importance that the position of the cork should be longitudinally over the course of the artery, so that the blood-current is checked as much by the downward pressure of the cork as by the upward tension of the wire, the intervening tissues forming a firm compressed pad. The superfluous ends of wire are then cut off, and the wound closed and dressed according to the predilections of the Surgeon.

Effects of compress. When the depression of anæsthesia goes off and the circulation revives, it will be found that a *feeble* pulsation returns in the aneurism. This, according to the author (who strongly advocates the *gradual* rather than the *rapid* method of producing coagulation in the sac), should be allowed to go on for two or even three days, when the wire is to be tightened in the following manner:

The cork being firmly pressed down over the artery, the wire is drawn upwards by gentle traction on its twisted ends, and two or three small wooden wedges are pushed in *by an assistant* between the cork and the wire, so that sufficient tension is caused to *entirely* stop all pulsation in the aneurism. If the wire has been sufficiently drawn tightly at first very small wedges are required, such as two or three bits of a lucifer match, for instance. The wire is on no account to be twisted afresh, lest it break. Meanwhile, by the action of the two or three days' feeble current the sac has been prepared, as it were, for the coagulation of *sudden soft* clot which is now formed, whilst the collateral circulation has also by the same means been encouraged, the result being that in from twenty-four to forty-eight hours consolidation is perfect; thus about the fifth or sixth day the cure is complete, and the compress may be removed, which is thus done:—Un-

he wire and remove the cork; separate widely the two ends of re to lessen the curve as much as possible; clip off one end close skin; make gentle pressure with one finger where the cork has nd by steady traction on the other end of the wire it is readily awn. If it should seem to adhere, leave it till next day, it must have become loosened in the tissues, and will be easily able. How to remove compress.

advantages of this method are thus summarised by Mr. Dix:

The wire does not cause ulceration or any damage to the coats of tery, either external or internal; therefore the blood-channel unopened, *bleeding*, one of the chief dangers of the old operation, ossible.

By causing at first a *retarded* circulation and a diminished it, it most accurately imitates the *natural* cure of aneurism, and owing time for the establishment of the collateral circulation the f gangrene, the *second great danger* of the ligature, is very much ished.

nevertheless, there were coldness of the limb and a threatening ngrene, the wire can be at once untwisted and relaxed, or even ed.

Ultimately, the current through the artery and the sac is en- obstructed so as to produce the needful clot. Of course, this ete obstruction can be effected at first if desired; and, therefore, peration does what an operation, by ligature or forceps, cannot z. it gives the Surgeon a choice between the rapid and the gra- nethod of treatment.

will be seen that, in the opinion of the author, the *gradual* d is much to be preferred, and he considers it one of the chief s of his operation that this effect can be produced.

The wire does not act as a foreign body in the wound, setting ppuration and impeding the healing process as a ligature does.

It is not a fixture upon the artery remaining for an indefinite l, but, its work being done, it can be at once got rid of.

The clot produced by this concurrence of the gradual and rapid d is less likely to break down and suppurate than the soft sudden which is the effect of the ligature.

. And lastly. As there is no possibility of bleeding from the , the Surgeon has a wider choice of locality for operation. For ice, the common femoral or the external carotid, which, on account morrhagic risks, are usually avoided by the operator, may be treated on this plan, which is indeed applicable to all arteries

.—Inasmuch as it does not obliterate the artery at the site of plication of the wire, this procedure, *in its present form*, is not le for the distal operation, but it is probable that complete occlu- nd obliteration may be effected by the simple modification of ap- *two* wires upon the vessel about half an inch apart, between a clot would form and become organised.

s method is quite trustworthy in traumatic aneurism and in a led artery where a wire should be applied on either side of the in the artery and the vessel divided between them. It has roved successful in amputation, &c.

The Treatment by Ligature.—When the treatment of an aneurism

Treatment by ligature.

by compression in one of its forms is inapplicable either from the positi of the aneurism, or from the unsatisfactory condition of the patien or when such treatment has proved unsuccessful, then the treatm by ligature should be entertained, and this should be carried out b

Hunterian method.

the Hunterian method (Fig. 135), that is, by the application of a lig ture at some distance from the sac, rather than by the "méthod d'Anel," in which the ligature is applied close to the aneurism. Th advantages of the Hunterian operation are the slight flow of bloo through the aneurism, when the main flow is arrested; the mainte nance of the collateral circulation; and the probability of the arter being more healthy at some distance from, than close to, the seat o disease. The operation is also, as a rule, less difficult.

FIG. 135.

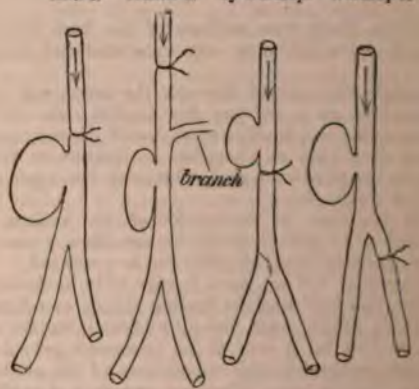


Diagram showing the different operations for aneurism.

The ligature employed should be either of carbolised silk, or aorti kangaroo tendon, or prepared catgut. The ends of the ligature should be cut off short, after the band has been tied, and an attempt should be made to get quick union of the wound. To leave the ends of the ligature long, encourages suppuration and ulceration of the artery at the point of ligature; the vessel may ulcerate through, or a portion of the artery may slough away with it, a process which takes from nine to twenty days, or more in large vessels. With the prepared catgut ligature now employed, some ulceration of the vessel at the seat of ligature may likewise follow, but a complete division of the artery by ulceration need not take place. On that account the catgut ligature is preferable.

Causes of death after ligature.

Causes of Death After Ligature.—When the ligature fails, and death ensues, it is from gangrene of the parts below the seat of disease, from secondary hæmorrhage. The former is the more frequent cause of death, and according to Dr. Norris, out of fifty fatal cases of ligat...

oral artery, twenty-three died of gangrene, and only eight of
re. To lessen the risk of hæmorrhage some excellent Surgeons
n the last few years returned to the old practice of ligating
in two places, and dividing it between the ligatures. They
this under the idea that by such a practice the tension of the
essened, and, as a consequence, the risks of bleeding are
. Signor Corradi, of Florence, follows this method as a
Dr. J. Lidell advises it.

Ashhurst's 'Internat. Encyclop. of Surg.,' vol. 3.

ligature is applied to the main artery of a limb, the circula-
a time, more or less cut off, consequently coldness of the
ven gangrene may ensue; congestion, however, generally
gradually in the extremity from the blood being forced
llateral vessels, and with this, some increase of temperature
t, with hyperæsthesia. This point has been already noticed
arks on embolic arterial obstruction. Brown-Séquard ex-
elevation of temperature that is often observed in a part
pplication of a ligature to its main artery, by the paralysis
-motor nerves that ramify on or in the coats of the vessel;
is producing a corresponding paralysis of the ramifications
els, and, as a consequence, the blood finds its way freely
ie collateral branches into the part below the seat of the
his increased activity of the collateral circulation produces
ngestion of the part as well as the concomitant elevation
ture. ('Archives de Physiologie,' 1851.) The Surgeon
ever, after the application of a ligature, do what he can
the temperature of the limb, which is best effected by
thickly with cotton wool, at the same time keeping the
to encourage the venous circulation. Simple nutritious
be allowed, but stimulants only with great caution, and
merely enough to help digestion and maintain the force
's action—the habits of the patient forming the best guide
ity. Should pain be present, opium, morphia, or chloral
scribed, either by the mouth or subcutaneously.

Effects of ligature.

Treatment immediately after ligature.

ligature has separated, the wound healed, and the aneurism
, no forcible or prolonged exercise of the limb must be
some weeks, although gentle exercise is beneficial. The
also be kept warm, for it has happened that the circulation
as failed to become full or even sufficient, after the opera-
ome permanent weakness and loss of sensation has been
ent may, however, live a long life even after a double opera-
864 I saw a man, æt. 51, upon whom Mr. B. Cooper had
enty-three years before (1841) for popliteal aneurism of
and of the right in 1843. He had been an orange porter,
uently followed his work. When gangrene takes place, it
as a direct result of the cutting off of arterial supply from
of the ensuing blood stasis. As a consequence it occurs
w days of the operation. It may, however, be produced by
of an inflamed or rapidly increasing aneurism, and has
or nothing to do with the operation. It should be dealt
tically. If it spread rapidly, and threaten life, ampu-
he limb about the line of ligature should be performed
y. Should it, however, be limited in its nature, and slowly
the expectant treatment must be employed. The warmth

Subsequent after-treatment.

Gangrene of limb after ligature.

Its treatment.

of the limb at the same time should be carefully looked to, the sloughing or dying parts covered with well-oiled lint, the venous circulation assisted by the elevated position and by gentle friction, and the powers of the patient stimulated by food and wine; opiates being administered for the alleviation of pain.

Suppuration of sac after ligature.

When the sac of the aneurism inflames and suppurates after the application of a ligature, the case may be regarded as one of local gangrene, the result of the operation; it is a dangerous complication, and no definite rules can be laid down for its treatment. Hæmorrhage is occasionally a result of this action, the blood coming from the lower end of the vessel; pyæmia or blood-poisoning is another. In general, when an aneurismal sac suppurates, amputation is the best practice when it can be performed, and where it cannot, the operation of Antyllus may be successful as in a case of carotid aneurism reported by Mr. H. Morris, 'Med. Chir. Trans.,' vol. lxiv. In August, 1871, I applied a ligature to the left carotid artery of a man æt. 29, for a large aneurism, and death ensued on the thirty-fourth day from suppuration of the sac and sloughing of nearly the whole aneurism. This process had been preceded by some hæmorrhage on the thirteenth day after the operation. The same result may take place after the cure by compression, rapid or slow. It is an open question, however, whether aneurismal sacs that have been suddenly filled with coagula are not more liable to break up and suppurate than others in which the process has been more gradual.

Pulsation in sac after ligature.

In rare instances after the Hunterian operation the pulsation of an aneurism reappears; and a passing, feeble pulsation in the sac a day or two after the application of the ligature is by no means a rare occurrence; nor need it excite any alarm, as it is doubtless due to the passage of a feeble current of blood through the sac by means of a collateral branch. This is more likely to occur when a cure by pressure has been previously attempted and failed, the collateral circulation having been enlarged by the pressure. Should, however, the *pulsation continue persistent*, even after the application of a ligature to the main trunk, it will be fair to infer that a 'vas aberrans' exists, by which the blood is brought direct to the aneurism, and which must be ligatured before a cure can be expected. At times the existence of this 'vas aberrans' may be made out at the time of operation, when the vessel must be looked for when the main trunk is tied; indeed, it may be possible that no necessity will be found to tie the main trunk, as the operation for aneurism is to tie the vessel that supplies the sac, and this may be connected only with the 'vas aberrans.'

Vas aberrans.

Operation of Antyllus.—Should it not be possible to apply a ligature to the efferent vessel, and the case is one in which other means are inapplicable, or the aneurism is clearly the result of a wounded artery, the formidable original operation for aneurism—that of "Antyllus" practised more recently by Syme—may be required, which is the laying open of the sac of the aneurism, the removal of its contents, and the application of a ligature above and below its connection with the artery. To do this, however, much boldness and operative skill are necessary to prevent a fatal hæmorrhage. With this object, in a case of axillary aneurism, Mr. Syme made an incision above the clavicle along the border of the sterno-mastoid muscle to enable an assistant to compress the subclavian artery against the first rib; acting upon the same principle as he adopted thirty years before, when he made an incision

Operations of Antyllus and Syme.

'Med.-Chir. Trans.,' vol. xliii.

the angle of the jaw to enable an assistant to compress the
maxillary artery before the removal of the upper jaw. In
laid open a gluteal aneurism, having previously thrust a bis-
ito the tumour over the situation of the gluteal artery, and in-
d a finger so as to prevent the blood from flowing except by
ial gushes. He eventually thrust his hand into the sac, rapidly
out the clot, and had the bleeding orifice at once under sub-
by the pressure of the hand. Both cases did well. Still this
is only applicable to desperate cases, where all other modes of
nt have failed, or are out of the question. In aneurisms of small
, however, it is very applicable. I have successfully employed
iny cases of aneurism of the radial and ulnar arteries for trau-
neurism with good results, and in several cases I divided the
ompletely and twisted both ends, a rapid recovery following.

al ligature.—When a ligature cannot be applied to the cardiac Brasdor's or distal operation.
an aneurism, and the treatment by compression has failed or is
iable, the distal operation of Brasdor's, or the application of
re to the vessel as it leaves the aneurism (Fig. 135) may be
ned, with the view of assisting coagulation of blood in the Distal operation in aortic aneurism.
n by "slowing" the blood current, for it may fairly be accepted
ed by the cases of C. Heath, Annandale, Holmes, and Barwell,
e application of a ligature to the left carotid artery in aneurism
aorta is of benefit. The credit of the suggestion, however,
e given to Dr. Cockle, who wrote on the subject ('Lancet,'
although three or four cases had previously been recorded,
ch the operation had been performed with success for sup-
arotid aneurism. Evidence likewise exists to show that the
tion of a ligature to the *right* carotid artery in cases of inno-
or mixed innominate and aortic aneurism may do good. This
is to be followed up if needs be by the application of a
to the subclavian vessel, Mr. Fearn's case and others having
ie repetition of the operation justifiable. In August, 1871, I
ied Wardrop's operation on a man æt. 33, for innominate aneu- Case of Wardrop's operation.
The subclavian was ligatured with a carbolised catgut ligature,
nd closed and sealed with lint saturated with the compound
e of benzoin. A good recovery ensued, and considerable con-
on of the aneurism. The man left the hospital thirty-six days
ie operation so well satisfied with the success of the treatment
did not return to have the carotid ligatured; indeed, he went
well up to about six weeks before his death that he thought
of his trouble. He died from dyspnœa the result of pressure,
ust, 1874, three years after the operation. After death the
m was found to be full of solid clot, and there was a passage
h it to the carotid, with a smooth lining. Unfortunately, the
nan who took out the preparation threw away the bulk of the
at filled the sac, which was as big as a fist. The success of the
on, however, was encouraging.

The Treatment by Manipulation.

method was introduced into surgery in 1852 by Sir W. Ferguson, 'Med.-Chir. Trans.,' vol. xl.
s based on natural although exceptional processes, viz. the em-
clusion of the distal end of an artery by a dislodged clot. It is
ally to be carried out by the manipulation of the sac of an

aneurism with the view of dislodging the blood clot it may contain with the chance of such being carried by the circulation into the afferent artery. It may likewise be employed "to alter the relations of the laminated fibrine in the cavity of the aneurism, so as to bring about a further deposition of fibrine on the projecting surfaces of the displaced laminæ" (Oliver Pemberton's 'Address on Surgery,' Brit. Med. Assoc.). Sir W. Fergusson practised it in two cases, and in both the success was sufficient to sanction the repetition of the means in appropriate cases, and when all other treatment is out of the question. Holmes told us ('Lancet,' vol. i, 1873, p. 159) that it had been used in five cases of subclavian and two of femoral aneurism. In two cases a cure was obtained, and in a third it was probable. In cervical aneurism the practice is not applicable on account of the dangers of embolism of the cerebral arteries.

Galvano-puncture, or Electrolysis.

Galvano-puncture.

To induce or assist coagulation of the blood in the sac, other means have been suggested, and of these *the treatment by galvano-puncture* as advocated by Abeille in 1849 ('Arch. Gen. de Medecine'), and by Ciniselli in 1856, is one of the most promising in theory, though the practical results have not been equally satisfactory. It consists in the introduction of the two needles of a constant current battery into the sac, with the view of coagulating the blood into a firm clot. The practice is one that can only be entertained in exceptional cases, *i.e.* in those which cannot from their position be submitted to other forms of operation. It is, however, well adapted for the treatment of aneurisms at the root of the neck and the thoracic aorta, and possibly for some forms of abdominal aneurisms.

How applied.

The constant current battery should be used, and a moderate current, say of five cells, be first employed, its strength being increased gradually, but never to cause pain. The battery may be used for half an hour at a time, about twice a week, yet this will depend upon its effects. The needles should be of steel gilt, sharp, very fine, and about three inches long, and should be insulated to within half an inch of the point. They are to be introduced and removed with a rotatory motion, and may be attached to either pole of the battery. The dangers of the operation are, as stated by Holmes, principally from two causes, "the inflammatory action produced in the sac and the cellular tissue which surrounds it, and the gangrene or ulceration of the skin at the points of entrance of the needles."

Other Methods.

Injection of sac.

THE TREATMENT BY INJECTION is a mode that demands notice, although hitherto it has not been satisfactory. Alcohol, tannin, acetic acid and the perchloride of iron have all been used as coagulating agents, but the last is the drug for which the most can be said. That it has a powerful influence in causing the coagulation of the blood is well known; but to produce this in the sac of an aneurism is a dangerous proceeding. The most dangerous result is embolism, and the next, inflammation and suppuration of the sac. A solution of the perchloride, diluted to one twentieth the strength of the British Pharmacopœia preparation, is strong enough, and not more than about twenty drops of the solution ought to be dropped into a large sac. The graduated glass syringe with screw piston should be employed, such as is gene-

(5) That a ruptured artery in parts less fascia-bound than the leg (as, for instance, the arm) may be treated more as in the case of injuries to arteries, by the application of a ligature to the wounded vessel.

Collateral circulation.—When an artery is obstructed, the circulation is carried on by what is called the collateral circulation in which the

On the collateral circulation after ligature.

A.—Anterior view. FIG. 136. B.—Posterior view.

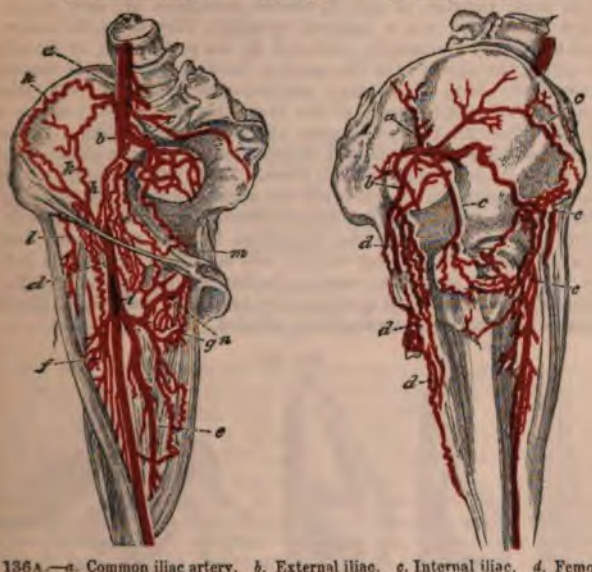


Fig. 136A.—*a*. Common iliac artery. *b*. External iliac. *c*. Internal iliac. *d*. Femoral. *e*. Profunda. *f*. External circumflex. *g*. Internal circumflex. *h*. Iliac artery, which had been tied and had shrivelled into a cord. *i*. Remains of aneurismal sac. *k*. Anastomosing branches of the circumflexa ilii. *l*. Anastomosing branches of the circumflexa externa. *m*. Obturator artery, anastomosing with, *n*, circumflexa interna.
Fig. 136B.—*a*. Gluteal artery. *b*. Ischiatic artery. *c*. Anastomosing branches of gluteal with the circumflex. *d*. Anastomosing branches of ischiatic with the perforating branches of the profunda. Prep. 1519[12], Guy's Museum.

vessels coming off above the obstructed part communicate with those which arise below it. At first the vessels are very numerous, but as time goes on their number diminishes, and only those most conveniently situated for carrying on the circulation become rapidly or gradually and permanently enlarged.

To illustrate this beautiful compensatory natural act I submit two drawings (Fig. 136), taken from a preparation in Guy's Museum, made by Mr. Cock in the year 1826, from a patient æt. 58, in whom Sir A. Cooper had applied a ligature to the external iliac artery for femoral aneurism eighteen years and a half previously.

A full description and preparation of the case is to be found in the first volume (first series) of the 'Guy's Reports,' by Mr. Cock. The drawings need no lengthy description, as they explain themselves.

Arterio-venous Aneurism.

On arterio-venous aneurisms.

When an artery and a vein communicate with each other, the arterial blood passing *directly* into the vein without the intervention of a sac, *an "aneurismal varix"* is said to exist (A, Fig. 137); and when a sac exists into which the arterial blood flows in its passage to the vein,

Varieties.

this condition is called *a "varicose aneurism"* (B, C, and D, Fig. 137). Both these varieties of arterio-venous aneurisms are now rare; but when venesection was a common operation they were far more frequent; as they are usually produced by the perforation or division of an artery through a vein, the opening between the vessels remaining permanent. Both forms may originate spontaneously from disease. Goupil (Paris, 1855) recorded the fact, that out of fifty-seven cases of this affection, thirty-one were the result of bleeding. Cases are on record where the aorta and superior or inferior vena cava communicated. Wade ('Dublin Med. Press,' 1861) has recorded a case in which an opening existed between the aorta and pulmonary artery; in 1882 I saw a case with my colleague Mr. Davies Colley in which this condition existed between the superficial femoral artery and femoral vein the result of a gunshot wound; and my friend Mr. Morris informs me, that he has seen a like case in the femoral region, the result of a pistol shot received by a sportsman in America. Indeed, all the large arteries and veins may be similarly affected.

Fig. 137.



Illustrating the different forms of varicose aneurism. A. The artery and vein directly communicating. B and C. The dilation being more in the vein. D. Aneurism laid open.

Aneurismal varix.

In an *aneurismal varix* the vein assumes in some degree the properties of an artery and becomes enlarged from the arterial impulse. Besides being irregularly dilated and tortuous, the dilatation assumes a fusiform or sacculated appearance, while it also becomes thickened and pulsates, the mixed blood currents giving rise to a peculiar though characteristic "buzzing" murmur, which when once heard is not likely to be mistaken.

In some instances the condition is congenital; it was so in the case illustrated (Fig. 138), in which the seat of communication of the vessels was about the axilla. The boy, æt. 14, was admitted under my care at Guy's, in 1879, for bleeding from an open ulcer on his left index finger, the ulcer having followed an injury eighteen months

previously. The injured finger was spongy from vascular tissue, and the palm of the hand had the appearance of a cutaneous nævus. The veins of the whole limb were immensely distended and thrilled very markedly; the buzzing murmur so generally present in these cases was very characteristic. The case was treated by elevation of the limb

Fig. 138.



Aneurismal varix.

after it had been firmly fixed to a splint; under such care there was no recurrence of bleeding, and a rapid healing of the ulcer on the finger followed. It was not thought expedient to interfere with the disease.

In the *varicose aneurism* the sac may or may not freely communicate with the artery or vein. In some cases it will involve the whole calibre of both vessels; or the vein may be hypertrophied and enlarged, as in the aneurismal varix. In a unique case (Fig. 139) recorded by Mr. Cock ('Med.-Chir. Trans.,' 1851), of a traumatic varicose aneurism of the popliteal artery, the sac was small but involved the whole calibre of the artery and vein, and the whole of the arterial blood passed through it. The secondary effects of the disease were also shown with singular clearness. It occurred in a man æt. 28, who eleven years previously had received a punctured wound in the popliteal artery for which two weeks subsequently, on account of secondary hæmorrhage, the femoral was ligatured. He convalesced and returned to his work, but two years afterwards became the subject of "varicose veins." He remained well until three or four months before his admission into Guy's, when he had fever, and, on convalescing and trying to walk, discovered his leg was stiff, painful, and swollen. He was admitted with what was supposed to be a large collection of pus beneath the superficial muscles of the calf. The femoral artery below Poupart's ligament and the anterior and posterior tibial arteries were pulsating freely. The cavity was opened, some ounces of dark grumous, pitchy, non-coagulable blood escaped. The next day a quantity of offensive pus flowed away mixed with coagula. For a fortnight everything went well, when arterial hæmorrhage took place, and he lost nearly three pints of blood. After due consultation, amputation was performed, from which an excellent recovery ensued.

Varicose aneurism.

On dissecting the limb, Mr. Poland found connected with the popliteal artery an aneurismal sac (Fig. 139, *s*) the size of a pigeon's egg; which was of cartilaginous hardness, and lined with fibrine. The artery (*A*) freely entered the sac from above. The vein (*V*) was

obstructed above with coagulated blood, and below was lost in the walls of the sac as a fibrous cord. From the lower part of the sac two vessels issued, the smaller one (*a*) was the continuation of the popliteal artery *greatly diminished in size*, which divided as usual to the leg. The larger (*v v*) was the popliteal vein greatly hypertrophied, pouched and puckered. It was quite pervious, and passed down for about two inches, when it divided into two trunks; one, which accompanied the anterior tibial artery, was quite *obliterated*, the other led directly into a *second aneurismal sac* (s^2) the size of a duck's egg, with the walls of which its coats became identified. It was this that had been opened. From the lower part of this *venous sac* emerged three or four large impervious branches that were clearly veins accompanying the posterior tibial and peroneal arteries. The contents of these vein could be washed out and the valves seen.

FIG. 139.



Mr. Cock's case of arterio-venous aneurism.

It should be added that the cutaneous veins above described as varicose were greatly hypertrophied, and it was evident that the whole of the blood from the leg was returned through them.

It would appear also that in this case, as a *direct* result of an injury, a *varicose aneurism* formed, into which the whole of the arterial blood flowed. Moreover—

That the arterial blood subsequently found a more direct course through the popliteal vein than through the artery, and as a result the vein became hypertrophied and the artery atrophied. Also—

That the force of the arterial blood current upon the thin coats of the vein caused the gradual dilatation of the vein and the subsequent formation of an aneurism in its course; and that by the giving way of this aneurism bleeding had taken place.

The wasting of the femoral vein *above*; and the hypertrophy of the same vein *below* the upper sac, from its taking on the functions of an artery, are points of interest; and not the least important change was the great hypertrophy of the cutaneous veins through which the whole of the venous circulation of the leg must have been carried on.

I have given this case at some length because it illustrates better than any general description the whole effects, primary as well as secondary, of a varicose aneurism.

With reference to diagnosis, it may be stated that at the point of junction of the arterial and venous streams, a peculiar burring bruit is often felt and heard, and this bruit frequently extends along the course of the dilated veins. Where a sac exists in which the two blood currents meet between the artery and the vein there is likewise a sac bruit. The sac is rarely very large, and is made up of condensed cellular tissue and plastic matter.

TREATMENT.—In these cases surgical interference is not generally required. Should, however, the disease be extensive, and either from

pain, mechanical causes, or chances of rupture of the vessels, require treatment, a cure may be attempted by the occlusion of the artery above and below the point of communication between the artery and the vein. The case should be treated as one of wounded artery. The vein need not be interfered with, as it will gradually wither so soon as its arterial communication has been cut off. Treatment of arterio-venous aneurism.

Pulsating exophthalmos, or vascular protrusion of the eyeball, associated with a marked swelling and enlargement of the vessels, a peculiar rushing bruit, and arterial pulsation, is an affection of much interest and of some obscurity, since it may be due to intraorbital aneurism, to rupture of the internal carotid artery into the cavernous sinus, or to some condition of vessels apparently independent of arterial disease. Mr. Bowman's dissections have fairly demonstrated that this affection may exist during life, and after death show no pathology. Mr. W. Rivington has written an excellent article upon this subject ('Med.-Chir. Trans.,' lviii), and has proved that in many cases this affection has been preceded by some fracture of the base of the skull, complicated, probably, with laceration of the venous sinus and obstruction or laceration of the internal carotid artery, and in idiopathic cases the like changes probably exist; in fact, some of these cases of pulsating exophthalmos had better be looked upon as examples of arterio-venous aneurism. Pulsating exophthalmos.

TREATMENT.—Some of these cases do well without treatment; but when they show evidence of steady progress Rivington's facts clearly prove the propriety of applying a ligature to the common carotid artery, success having followed this practice in fifteen out of eighteen idiopathic and twenty-three out of twenty-six traumatic cases.

Cirsoid Aneurism, Erectile Tumours, and Aneurism by Anastomosis.

These have nothing in common with the spontaneous and traumatic aneurisms that have been already described, beyond the fact that they are diseases of the arterial system. They are vascular tumours made up of arterial tissue and formed by a dilatation and elongation of arteries; the term *cirsoid aneurism* being employed when the trunks of the larger vessels are involved (*vide* fig. 140A), and *aneurism by anastomosis*, or cirsoid arterial tumours, when the smaller vessels or capillaries are affected. In the cirsoid aneurism one vessel or many vessels may be diseased—the disease showing itself by the artery becoming tortuous, dilated into pouches, and convoluted. When one vessel alone is affected Gosselin called it *arterial varix*. When the disease is on the scalp (its most common seat), three or four large tortuous arteries may be seen converging to the centre, where a congeries of dilated arteries will be found, probably of new growth. It may, however, affect the arteries of the extremity. I have seen it in the

On cirsoid aneurism.

FIG 140A.



Cirsoid aneurism of temporal artery. Taken from a man æt. 43, who was under my care in 1881.

foot (Fig. 140B), and Cruveilhier has reported a case in which the external iliac artery was so affected. Cirsoid aneurism is generally found in young people, during the period of growth, and in the majority of cases can be traced to local injury. It can be readily made out by its

FIG. 140B.



This drawing was taken from a patient of Mr. Poland's, a girl æt. 19. The disease followed an injury, and was treated by amputation, other measures having failed ('Guy's Hosp. Rep.,' 1869.).

pulsating nature, and the peculiar tortuous and convoluted appearance of the diseased vessels, not only of the vessels forming the tumour, but of the arteries by which it is supplied.

Treatment of cirsoid aneurism.

TREAMENT.—All forms of treatment have been tried in these cases, such as direct pressure, injection, the application of ligatures to the vessels that converge towards the growth, and to the main artery that goes to the part; the tumour has, moreover, been laid open and treated by pressure, with the view of causing its obliteration by inflammatory exudation; Gräf, Bell, Arnott, and Lawrence have each recorded successful instances of this form of practice, but no good success in the majority of cases has been achieved.

Example.

The best success has, however, followed the removal of the growth either by the application of the ligature or by excision. In 1876 I excised a cirsoid aneurism, situated below the jaw in connection with the facial artery, from a lady, æt. 25, with success. In 1867 I treated a boy, æt. 14, for a large cirsoid aneurism of four years' growth, situated on the right temple. It was supplied with blood by tortuous vessels converging from all quarters, and pulsated freely. I applied acupressure pins to all these vessels, even to their division, without success; the growth for the time became flaccid, but quickly reappeared and increased. Under these circumstances I excised the tumour, making my incisions at some distance from its margin, and ligatured about twenty large vessels as I proceeded; a rapid recovery followed, and the boy was well three years later. In this case it was remarkable to see how rapidly the tortuous convoluted arteries that supplied the tumour withered and became of their normal size so soon as the central disease was removed. This process illustrates John Hunter's opinion that "vessels have a power of increase within themselves, both in diameter and in length

to the necessity of the tissues, whether natural or diseased;" ates that the attracting power had its centre in the growth, the afferent arteries. In a third case, that of a girl æt. 12, the aneurism by a subcutaneous ligature with like success; recently, in a man who had such a vascular pulsatile growth cheek, which appeared to have had all the afferent arteries ut success before he came into my hands. I ligatured the ss subcutaneously, and a recovery followed. Four years ever, the disease returned, and in June, 1877, I excised it— healing rapidly. Indeed, the only successful cases of treat- rsoid aneurism that I have dealt with or seen, have been those he growth itself was treated by removal.
f aneurism by anastomosis are very amenable to treatment by ection, the galvano-cautery, or the ligature.

Nævus.

iectasis, Erectile Tumour, or Angeioma, is essentially a dis- On nævus.
e capillaries, appearing in a general way to be made up of a ascular tissue, the tubes freely intercommunicating with each is true the walls of the vessels are indistinguishable in an case of the disease, the nævus appearing as a collection of aces, opening widely into one another, through which blood hen the arterial supply is very free, the growth appears rm, and pulsatile, and is then called an *arterial nævus;* Arterial.
venous element predominates, the growth is less florid, has a bluish appearance, and does not pulsate, and is termed a *vus.* Venous.
rowths for the most part appear in the skin or subcutaneous frequent on the head and often multiple. Rare examples ord where they affected deeper parts, even the viscera and (*vide* Wilks and Moxon, 'Path. Anat.,' and Morris, 'Path. ol. xxii). In a clinical point of view they may be divided *utaneous* or pure skin nævus, the *subcutaneous* or cellular Cutaneous.
vus, and the *mixed form*, where both tissues are involved; Subcu-
tinction has an important practical bearing. Nævi are, as a taneous.
sed, that is, they have no distinct capsule, but in many cases ncysted, and may be treated accordingly. Venous subcu- nævi appear to be more frequently encapsuled than the cu- nd arterial.
oreover, are generally congenital, or make their appearance Congenital.
r birth. They occur, however, at a later period of life, and to be due to some injury or wound. These nævi at times kly, the cutaneous form rapidly spreading; the more florid Their
ial the growth the greater is its tendency to spread; the progress.
vus is less progressive. They may grow also for a time and ; indeed, they all have a tendency to become stationary after nd even to degenerate. It is not uncommon to meet with have begun to undergo this process before the birth of the d I could adduce many cases in which the nævus was or even sloughing at birth. In feeble or cachectic children May ulcerate.
ncommon for these "marks" to ulcerate or slough, and, after ever, or other depressing illness, the destruction of the sometimes very rapid. These facts show that nævi, although

May degenerate.

blood tumours, are not long-lived growths, and have a tendency towards early death. When they do not ulcerate or slough, they undergo degenerative changes, and the most characteristic is the cystic form (Fig. 141 and Plate ii, Fig. B). When the skin undergoes this cystic change, the surface becomes warty and vesicular, the vesicles containing more or less blood-stained serum (Plate i, Fig. 4). When the cellular tissue is the part involved, cysts will still appear of a like nature, but occasionally the whole growth passes into a mass of cysts of different sizes bound together by fibrous tissue. This degenerative change is very typical. To account for the formation of these cysts is no easy matter, no satisfactory explanation indeed of their production has yet been given.

Fig. 141.



Drawing of degenerating nævus. Guy's Mus., 1604.—Hilton's case.

Pigmentary nævi.

Some nævi are pigmentary, and are then termed moles. They are far less vascular than the forms already alluded to, and have no tendency to spread. They grow, it is true, with the growth of the subject, but as a rule in no greater proportion; in exceptional instances their increase is rapid. They do not appear to have a tendency to ulcerate, slough, or undergo the cystic degeneration like the vascular nævi, but have a special tendency to become the seat of disease, and particularly of the melanotic form of sarcoma or cancer. That is, subjects who become the victims of cancer and have moles, are often attacked primarily in such structures, and, as the cancer originates in a pigmentary growth, it takes on its character and becomes melanotic. I have seen many such cases, and so many others have been now recorded as to place the question beyond doubt.

Their tendency to become the seat of cancers.

Treatment.

Treatment.—Unless a nævus is so situated as to be an eyesore or an inconvenience, or unless it show a decided tendency to rapid increase, there is no necessity for operative interference. For a certainty, after a time, it will cease to grow, and also as certainly degenerate or waste, and under such circumstances it is not necessary to interfere. Should, however, the nævus be so situated as to be an inconvenience or a deformity; or should it grow so rapidly as to threaten to become either, something must be attempted, and this something is to be determined by the nature of the nævus and of the tissue in which it is placed. If *purely cutaneous* and not involving deeper tissues, it may be destroyed by some external application, such as caustic, nitric acid, or potassa fusa, chloride of zinc, ethylate of sodium, or tartarized antimony, the two former being applied directly to the part, the two latter in the form of Vienna paste, or otherwise. The hot iron and the gas or galvanic cautery are also very valuable destructive agents; one touch of either of these latter, steadily applied to the surface or as multiple punctures, destroying the growth, and with but little pain.

When interference called for.

Caustics.

Cautery.

In the *purely subcutaneous nævus* the treatment by caustics or cautery applied as a caustic is clearly inapplicable. When excised, as very often it is, *excision* is the best remedy, but care should be taken to save the skin. When such treatment cannot be adopted

Excision.

the nævus may be strangled by a ligature applied subcutaneously, as illustrated in the drawing Fig. 142, or it may be injected with the perchloride of iron of the pharmacopœia strength, with a solution of tannin in water in the proportion of ʒj to ʒj, or of the chloride of zinc grs. xij to ʒj of water, about twenty drops being thrown into the centre of the growth, care being taken beforehand to tear up the texture of the tumour with a needle. The object of this treatment is to coagulate the blood in the tissue, and thus promote its consolidation and cure. In many cases injection causes inflammation, suppuration, or even sloughing of the growth, and though in this manner a cure may be obtained, it is often by deformity.

Subcutaneous ligature.

Injection.

Fig. 142.



Mixed nævus with the ligatures inserted round its base subcutaneously before being tied.

The treatment by injection when the nævus is on the head or trunk is, however, attended with great danger, more particularly from embolism. I lost a patient where the nævus was on the cheek from this cause in a few minutes after the operation. For the above reason it is well to apply a ligature to the base of the growth and then inject; or to isolate the growth by means of the pressure of a metallic ring *before* injecting.

Dangers attending injection.

In the *mixed variety*, when the skin appears to have been involved secondarily by the extension of the disease from the cellular tissue, the nævus may be treated by excision, ignipuncture, subcutaneous ligature, or injection.

When the skin, with the cellular tissue, is extensively involved and the nævus defined, the whole may be removed by excision; but when otherwise, by ignipuncture or ligature. When the nævus is pendulous, or when it can be isolated from the parts beneath, excision is most suitable, and when hæmorrhage is dreaded, the base of the growth may be previously held in a flat clamp. In several instances I have excised the nævus by cutting on pins that have been inserted beneath its base; keeping the pins as points round which a ligature might be applied, and, by which the edges of the wound might be brought together. When the thickness of the lip is involved in the disease and the disease is limited, a V piece may be taken out with the growth advantageously, but when the whole lip is involved the growth may be dissected out, leaving the skin. The drawing below is of a case in which this operation was successfully practised (Fig. 143).

Treatment of mixed variety.

Within the last few years I have successfully treated many of the mixed varieties of nævi with the actual or galvanic cautery, by simply perforating them with the heated needle in many points (ignipuncture) introducing the needle at a black heat into the healthy margin of the growth down to its base. The cautery destroys the subcutaneous growth and with it the skin.

By ignipuncture.

The treatment of a diffused nævus by means of setons is a practice that can also be strongly recommended. Several setons steeped in the solution of the perchloride of iron are often sufficient to coagulate the

Setons in diffused nævi.

blood or to set up enough inflammatory action to cure the growth. When a nævus is extensive and is to be treated by the ligature, it may

FIG. 143

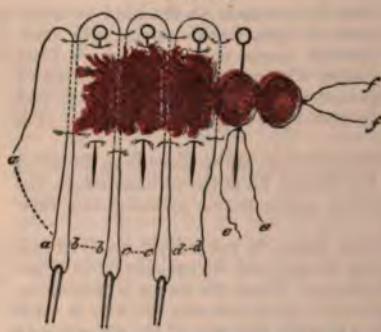


1. Nævus involving the whole of the upper lip. 2. After removal.
3. Flattening of the teeth from the pressure of the nævus (from 'Guy's Reports').

Piecemeal ligaturing.

be dealt with piecemeal (Fig. 144). It occasionally happens that the ligaturing of half a nævus cures the whole by the extension of the

FIG. 144.



Illustrating the method of ligaturing a large mixed nævus in sections around pins. At one end the pin has been removed, and the knot completed (*f*).

FIG. 144A.

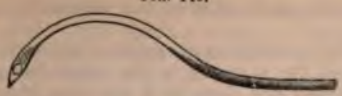


inflammatory action. In nævi involving the eyelids this suggestion is of value, and, in my own practice, several instances of cure have followed the application of a ligature to half the growth.

In a mixed nævus of moderate size when the cure by ligature is to be carried out, a pin may be passed beneath the growth, and also a needle at right angles to the pin, armed with a double ligature (Fig. 144A). The nævus is then strangled in halves by the ligatures tightly drawn beneath the pin; but before the ligatures are finally tightened it is well to puncture it to let out the serum and blood, to relieve tension, and to allow of the more perfect strangulation of the growth. When this act is completed the pin may generally be removed.

Small nævi may be vaccinated, although the chances of a cure by such means are very small. The same also must be said for compression.

FIG. 145.



The best needle for the application of a subcutaneous ligature to a nævus is shown above.

Bichet, "Aneurism," in 'Dict de Méd. et de Chir. Prat.,' vol. ii.—*Léon de Fort*, 'Diction. Encyclopédique des Sciences Médicales,' 1866.—*Broca*, 'Traité des Aneurysmes," 1856.—*Lisfranc*, 'Des différens Méthodes, &c., pour l'Oblitération des Artères,' 1834.—*Scarpa*, 'On Aneurism,' Wishart's Translation.—*Bellingham*, 'On Aneurism,' 1857.—*Tufnell*, 'On Treatment of Aneurism by Compression,' 1851.—*Holmes*, 'System of Surgery,' 3rd ed., 1883.—*Hodgson*, 'On Arteries and Veins,' 1815.—*Dr. Norris*, 'American Journal.'—*Dr. Stephen Smith*, Ditto.—*Erichsen's* Cooper's 'Surgical Dict.,' 1861.—*Wardrop*, 'Cyclop. of Surgery.'—*Syme*, 'Observ. in Clinical Surgery,' 1861.—*Fergusson, Sir W.*, 'Med.-Chir. Trans.,' vol. xl.—*Dr. Jones*, 'On Hæmorrhage.'—*Bryant* 'Lancet,' April 4th, 1874.—*Gould*, 'Trans. International Congress,' 1881.—*Holmes* 'St. George's Hosp. Rep.,' vol. vii.—*Ashhurst*, 'International Encyclop.,' vol. iii, 1883.

THE LIGATURE OF ARTERIES.—SPECIAL ANEURISMS, &c.

Importance of anatomical knowledge.

John Bell wrote seventy years ago "that the right way of securing a great artery is perhaps one of the most important points in practical surgery;" and I may add to do this with nicety and precision requires a sounder and more accurate knowledge of anatomy than any other operation.

"Before undertaking to tie an artery, the Surgeon ought to know its general course and its relations, and especially the prominent part or parts which are to guide him to the position of the vessel; he ought to have familiarised himself by frequent dissection with the thickness of the parts covering it, and their appearance as far as that can be judged of in the dead body; and finally, he ought to know the usual position of its principal branches, and the anastomosis by which the circulation may be expected to be restored. It is advisable also to be aware of the leading peculiarities in course, relations, bifurcation, &c., which the operator may perhaps meet with, and for which he ought to be prepared." ('Holmes's System,' vol. iii, p. 99.) In fact, without anatomical knowledge, any attempt to tie the trunk of a large artery must be surrounded with difficulties and fraught with danger, whilst with it, the operation becomes in the hand of an experienced Surgeon an act of precision and apparent simplicity.

In a former chapter, the mode of applying a ligature to a divided artery after operation, was discussed and illustrated; and in the present, attention will be directed to the application of a ligature to *an artery in continuity* as in the operation for aneurism, or the arrest of hæmorrhage from a punctured wound. To accomplish this, the Surgeon has to go through several stages of thought as well as of action. He has *first* of all to make out with precision the *exact course of the vessel to be ligatured*—which may be done by the artificial linear guides with which he ought to be familiar, the muscular guides to

General rules to be observed in operating.

its position, and the recollection of the anatomical relations of the vessel.

He has, *secondly*, to decide on *the point at which the ligature should be applied*. When for a *wound* in the vessel, this point is already settled, it having been laid down as a rule that, whenever possible, a wounded artery is to be exposed at the seat of injury, and two ligatures applied, one above and below the seat of lesion.

Point of selection.

When for *aneurism*, the question is more open, the "point for ligature" having to be determined by the Surgeon. In deciding this important question it should be remembered, that if the ligature be applied *too near* the aneurism, there is a risk of the ligatured vessel partaking of the disease for which the operation is required; and if *too far off*, the circulation through the aneurismal sac may be too free on account of the collateral circulation of the part.

But above all, the Surgeon should avoid selecting a spot *where an artery bifurcates or gives off large branches*; as under these circumstances, the clot that is required to plug the vessel behind the ligature must be absent, and one of Nature's most important hæmostatic agents become lost.

With the decision of these primary and important points the operation itself has to be considered, which resolves itself into *the exposure of the artery, its isolation, the application of the ligature around it, and the after-treatment*; the position of the patient for the operation being previously determined.

Position of patient.

The position of the patient should be such as to render prominent the anatomical guides to the course of the artery, to make the skin tense and to facilitate its division. *It should, moreover, be one of extension*, yet after the artery has been exposed, it is well to remember that the muscles of the part must be *relaxed*, as the artery is thus better brought into view and the subsequent steps of the operation are rendered more easy.

The exposure of the artery is to be made by incision, its course having been clearly made out, and the point determined on beforehand for the application of the ligature. The incision should be in the course of the vessel, its centre corresponding to the point where the ligature is to be applied, an occasional obliquity being sometimes practised when the exact position of an intermuscular interspace in which the vessel lies, is uncertain, and when the artery lies deep. It should, moreover, be free. It need not be so long in a thin as in a fat subject, nor in the case of a superficial artery as in that of a deep vessel; but under all circumstances, the skin wound should be enough to allow room for manipulation.

First incision.

The first incision should include the skin and superficial fascia down to the deep fascia, and, in making it, the operator has only to avoid the division of any large vein such as the external jugular in operations on the neck; or, saphena, in operations on the thigh. He should, consequently, mark out their position by arresting the circulation through them on their cardiac side, and make his incision parallel with them when they lie in his course.

When the deep fascia is exposed, it should be laid open, and in this step, the use of a director is sometimes valuable; the fascia, moreover, should always be divided to the full extent of the external incision. The student should remember that the trunks of all arteries, except

the cutaneous, are covered in by fascia. With the division of the fascia, the use of the knife can for a time be dispensed with, as the intermuscular septa and cellular tissue are readily separated by the handle of the instrument or finger, so that the sheath of the vessel can be thus well exposed.

If, writes Malgaigne, "immediately after the first incision, the Surgeon attempts to find the artery, he tries an impossibility, since he cannot reach it till after the last incision." He will then proceed uncertainly, and at random, hence the following rule of the guiding points:—"The Surgeon should not at the commencement occupy himself with looking for the artery, but should seek the first marked point of guidance, then the second, then the third, and so on to the end."

In looking for the sheath every anatomical guide is to be made use of to prevent undue manipulation or separation of parts.

Fig. 146.



This diagram represents three distinct operations A. Opening the sheath. B. Drawing ligature round the artery. C. Tying artery.

Fig. 147.



When the sheath is found and the pulsating artery is felt within, the end of the operation is not distant. Yet many errors may be committed. Every possible mistake should consequently be thought over beforehand in order to be avoided. The operator must ask himself as to the position of the nerves and veins about the part, so as to avoid them. He need not look for them as in a dissection, for this would necessitate superfluous manipulation, but their existence ought to be present in his mind. He should only remember their relative position to the vessel where the ligature is to be applied, and then guard against their being injured. The sheath having been found, it must *be raised by the forceps and carefully* opened (Fig. 146A), such *opening being only sufficient to admit* a probe or aneurism needle, and

Opening of sheath.

Passing of needle.

the less the sheath is separated from its vessel the better. The needle (Fig. 147) with the ligature is then to be passed (Fig. 146B), and it should be introduced between the artery and the vein, because when it is passed the other way the vein may be perforated or mistaken for fascia; yet in the hands of a careful Surgeon this point need not weigh against convenience. With the exposure of the artery all anxiety ceases, for to put an ordinary silk, wire, or catgut ligature around it is a comparatively easy task with the majority of arteries; so when this is accomplished the operation, as such, is all but completed. To do this, however, the Surgeon must be careful not to elevate the artery from its bed by the ligature, but to tie the knot with his fingers well passed down to the vessel (*vide* Fig. 146 C). He should also satisfy himself when the vessel is on the needle that pulsation exists, and that pressure arrests pulsation in the aneurism. When the ligature has been applied the displaced parts must be readjusted, the wound cleansed, its edges brought together, and some light application employed, such as dry lint or water dressing. Where the artery of an extremity has been tied the limb should be raised to facilitate the venous circulation, and cotton wool wrapped round the part to maintain its heat, but beyond this no local treatment is required. It need hardly be stated that an anæsthetic should invariably be given in these operations, and that the subsequent treatment of the case should be based on general principles. When veins bleed or large venous trunks require to be divided, they may be tied or twisted, though gentle pressure often arrests bleeding from small vessels. The wound should be carefully cleaned during the operation by the firm pressure of a well-squeezed sponge, the edges should be held apart after the sheath has been exposed by hooked directors, but the Surgeon on no account should allow his assistants to draw the parts so far asunder as to make them lose their relative positions. With these general remarks the application of a ligature to special arteries will now claim attention.

Care in ligaturing.

After-treatment.

Anæsthetic to be given.

Veins may be wounded.

Ligature of the Abdominal Aorta.

On ligature of the abdominal aorta.

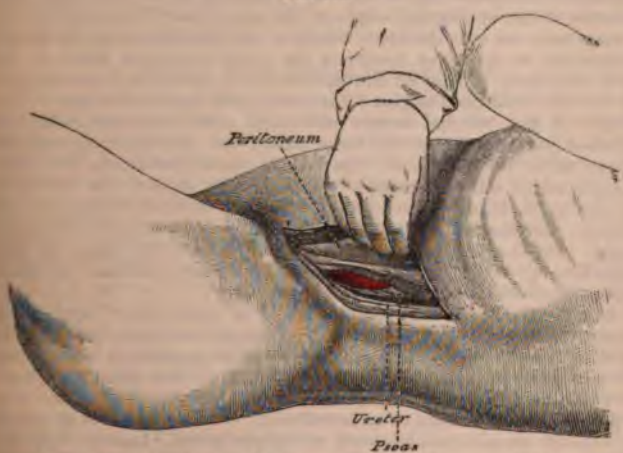
In 1817 Sir A. Cooper tied the abdominal aorta, having failed to find the communication between the common iliac artery and an aneurismal tumour, after the introduction of his finger through a small opening in the ruptured sac. He made his incision through the linea alba to the left of the umbilicus, directly over the aorta. The patient lived forty hours. James, of Exeter (1829), and Murray, of the Cape of Good Hope, followed his example with no better success, the patients surviving three and a half and twenty-three hours respectively. In 1842 ('Lancet,' p. 334) Dr. C. B. Monteiro, of Rio Janeiro, recorded a case, in which the patient died from hæmorrhage on the tenth day. In 1856 Mr. South ('Lancet,' vol. ii) operated on a patient who lived forty-three hours. In 1868 ('American Journal of Medical Science') Dr. McGuire, of Richmond, Virginia, recorded a sixth case, in which the patient lived twelve hours. In 1869 Dr. P. H. Watson, of Edinburgh ('Brit. Med. Journ.,' 1869) is said to have performed the operation on a man who survived it sixty-five hours; and in the 'Dublin Quart.' for 1869 Mr. Stokes, junior, has recorded an eighth case, in which a temporary ligature was applied, but without success.

In all these, the operation was performed for aneurism of the common iliac artery, but the results up to the present offer little encouragement for its repetition, more particularly when we have other means at our command holding out a better promise of success, such as pressure by the abdominal tourniquet, while the patient is under the influence of chloroform. Cures of abdominal aneurism by this means have been recorded by Dr. Murray, of Newcastle-on-Tyne ('Rapid Cure of Aneurism by Pressure,' 1871), Dr. Heath, of Sunderland ('Brit. Med. Journ.,' 1867, p. 287), Mr. Holden ('St. Barthol. Hosp. Rep.,' 1866), Dr. Moxon and Mr. Durham ('Med.-Chir. Trans.,' 1872), and Dr. Greenhow, ibid., 1873.

Cure of abdominal aneurism by pressure.

I believe, nevertheless, the operation of placing a ligature upon the abdominal aorta to be justifiable under exceptional circumstances, such

FIG. 148.



Incision for the application of a ligature to the aorta or common iliac artery.

as in cases of aneurism of the common iliac artery when all other means are inapplicable.

The best incision by which to reach the abdominal aorta is the *indirect*, a modification of that adopted by Sir P. Crampton in the case of the common iliac artery (Fig. 148), viz. one extending from the anterior superior spinous process of the ilium of the left side to the cartilage of the tenth rib, the peritoneum being reflected. The great difficulty in this operation is in the application of the ligature to the vessel.

'Med.-Chir. Trans.,' vol. xvi.

Ligature of the Arteria Innominata.

On ligature of the arteria innominata.

The first operation was by V. Mott, of New York, in 1818, and since then this artery has been tied eighteen times, but only once with success (by Dr. Smyth, of New Orleans, in 1864—the patient living

ten years), and in that case the carotid and vertebral arteries were likewise ligatured, the former at the same time as the innominata, the latter on the fifty-fourth day, for secondary hæmorrhage. Dr. Smyth accomplished this on the suggestion made by Mott in 1818, when he wrote, "by thus intercepting the retrograde current through the primitive carotid there would be less chance of any reflux hæmorrhage in the event of a phagædenic ulceration taking place in the wound." In all the other cases a fatal result rapidly ensued. Graefe's case lived sixty-seven, and Thomson's forty-two days ('Brit. Med. Journ.,' Oct. 14, 1882). It can only be entertained, therefore, in cases of injury to the carotid or subclavian near their origin, or in exceptional cases of disease. When decided on, the operation should be proceeded with as follows—

Operation.—The head being thrown back to the left and the shoulder depressed, the vessel may be secured by making an incision along the anterior border and sternal origin of the sterno-mastoid muscle; or, by a transverse one over the upper border of the clavicle making its centre correspond to the upper border of the sterno-clavicular joint; or by both combined. Under all circumstances the sternal and sometimes a part of the clavicular, origin of the muscle will require division. The sheath of the cervical vessels will then come into view, with the internal jugular vein on the outer side of the carotid artery and the vagus nerve between them. On tracing these downwards the innominate vessel will be reached. In a healthy subject the artery is always to be found behind the right sterno-clavicular joint, but in disease, its relative position may be altered by mechanical displacement. Dr. Cooper, of San Francisco, has reached the artery on two occasions by removing the sterno-clavicular articulation. A stout animal ligature should be used.

Cooper's operation.

On aneurism of the innominate.

In aneurism of the innominate there is no possibility of applying a ligature to its cardiac side, even if the disease involves only the upper part of the artery; yet as a rule this form of aneurism is almost sure to be associated with dilatation of the aorta. The distal operation, however, may be thought of, the carotid and subclavian arteries being ligatured simultaneously or consecutively. Of five instances in which the former practice was followed, one (Ensor's case, 'Lancet,' July 31, 1875) lived sixty-five days, and one recovered; while out of three of the latter an equal success may be recorded.

Brasdor's or Wardrop's.

The credit of the successful case in the former class, for a success I take it to have been, belongs to Mr. C. Heath, who tied the subclavian artery in the third part of its course as well as the common carotid simultaneously in 1865. The operation was followed by marked relief, and the diminution of the tumour; the woman æt. 30, survived the operation four years, and died from rupture of the aneurism. After death the aneurism was found to be of the aorta, the innominate being only slightly involved. (*Vide* Prep. in Mus. of Royal Coll. of Surgeons, and 'Path. Trans.,' vol. xxi).

The successful issue to the case in the latter class belongs to Mr. Fearn, of Derby, who tied the carotid in 1836, and the subclavian in the third part of its course two years later, for innominate aneurism. The patient died four months after the second operation from pleurisy. I had an opportunity in 1866 ('Path. Soc. Trans.,' vol. xviii) of carefully examining and reporting on this preparation, which is now in the

College of Surgeons' Museum, and a better specimen of a cured small sacculated aneurism could not possibly be seen.

Aneurism of the innominate has likewise been treated by ligature of the subclavian or of the common carotid alone, Wardrop's operation; and in Wyeth's Prize Essay, New York, 1879, and 'Holmes's Surgery' a most interesting list of references to such cases can be found. Out of eighteen, Evans's case, as recorded by Wardrop, was cured; his own lived two years; Morrison's case lived twenty months, two others lived six months, and the remainder lived only a few days or weeks.

In August, 1871, I ligatured the subclavian in a man, æt. 33, for this affection, and a rapid convalescence followed, with great diminution and consolidation of the aneurism. The man lived three years after the operation *vide* (page 515). This result, therefore, is not so discouraging as to preclude the question of operation in favourable cases. It should only be entertained, however, under exceptional circumstances, and more as a palliative than a curative remedy.

Ligature of the Common Carotid Artery.

Ligature of the common carotid.

This operation was first performed for aneurism by Sir A. Cooper in 1805, but unsuccessfully. The same Surgeon, however, had a successful case in 1808, the man surviving thirteen years ('Guy's Hosp. Rep.,' vol. i). The operation may be demanded for aneurism of the trunk itself or one of its branches, for erectile tumours of the orbit, or of the scalp, &c., and for wounds or hæmorrhage. It may also be called for as a distal operation in aortic aneurism. It is a dangerous and sometimes a difficult operation, but in a moderately thin subject it may be performed with facility. It should only be resorted to when all other means of treatment are inapplicable or have been found ineffectual; for aneurism it ought not to be performed unless the treatment by digital compression has been rejected. Holmes well sums up the matter in his College Lectures, 1873, as follows:—"That the experience of Surgeons hitherto leads to the conclusion that aneurism of the trunk of the carotid artery may be very often treated successfully by compression, and that the cure by compression frequently leaves the artery unobliterated, and therefore exposes the patient to a a far less risk of cerebral mischief than the ligature; that the ligature of the carotid for such tumours is extremely dangerous, and ought not to be undertaken until attempts, well devised and perseveringly carried out, have failed to effect the cure by compression; and that when the Surgeon has been compelled by the position of the tumour to place his ligature close to the proximal side of the sac, it is worth very great consideration whether it would not be better to evacuate the tumour, and tie the distal part of the artery also; finally, that cases do occur in which Brasdor's method holds out a rational hope of cure, but that this operation ought not to be practised except in cases of growing aneurism, when digital pressure checks the pulsation of the tumour, yet has failed to effect a cure." ('Lancet,' June, 1873.) The vessel may be ligatured in the upper part of its course at the apex of the carotid triangle, in a line with the cricoid cartilage, or lower down than this; the former position is the preferable and the operation there is more easy, and for disease of any of the branches of the vessel it should be selected. The latter should only be resorted to for disease of the upper part of the

Place of selection.

trunk itself. The course of the artery can always be made out, corresponding as it does with a line drawn from the sterno-clavicular joint to the angle of the jaw; the vessel divides on a level with the upper part of the thyroid cartilage, and should be tied opposite the cricoid. The centre of the incision made to expose it should be opposite to the cricoid, and should extend about three inches along the anterior margin of the sterno-mastoid muscle. The position of the patient should therefore be such as to render this muscle prominent, which is ensured by the extension of the head backwards, the face being turned to the opposite side.

Description of operation.

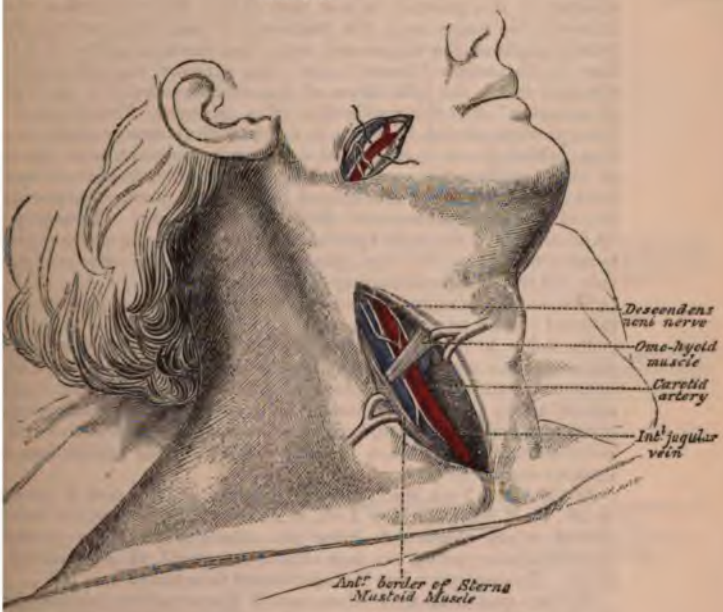
Before making the first incision through the skin, platysma, and superficial fascia the Surgeon should assure himself that no large vein, such as the anterior jugular, is likely to be divided; gentle pressure below, enough to interfere with the venous circulation of the part, readily supplies this information. The deep fascia covering in the sheath of the vessel may then be divided, care being taken to do this to the whole extent of the external wound. The sheath of the artery will then come into view, lying between the trachea and sterno-mastoid muscle; the pulsation of the vessel likewise can be detected. The head of the patient at this stage of the operation should be slightly raised, so as to relax the sterno-mastoid muscle, and allow its being gently drawn outwards by means of the retractor, as well as to permit of the separation of the cellular connective tissue of the part. The anterior belly of the omo-hyoid muscle will then probably be at once visible with its fibres passing downwards and outwards, and when this muscle is broad it will cover in a great part of the vessel. The descendens noni nerve may likewise be seen lying upon, or sometimes within, the sheath; due care should be taken that it is not wounded or included in the ligature; and if it be in the way it must be gently held aside by a retractor, as should be also any large vein that crosses the sheath. The inner border of the sheath is then to be taken up and firmly held with forceps, and a sufficient opening made in it by the knife held with its flat surface towards the artery, to allow of the introduction of the aneurism needle. The needle is then, as generally recommended, passed *armed*, though this is not a point of importance, for *unarmed* it is passed with greater facility. By a little manipulation the needle may be passed round the artery from without inwards, introducing it between the vein and vessel, and keeping its point close to the artery. The sheath may be dropped from the forceps, and the loop of the ligature seized, or the needle may be threaded, and withdrawn. The Surgeon must, however, satisfy himself beforehand that the right vessel had been exposed, and that the vagus nerve is not included. The vessel can now be tied, great care being observed that it is not raised from its bed or manipulated more than is necessary; the knot should be tightened by the index fingers passed well into the wound. The wound should then be adjusted and the patient put to bed, the most perfect quiet being enjoined. The Surgeon ought to remember all through this operation that the jugular vein is on the outer side of the artery, and often overlaps it; while the vagus nerve is behind, and the descendens noni in front (Fig. 149). None of these parts need be looked for, however, so long as care is observed that they are neither wounded nor included in the ligature.

The operation for ligaturing the *lower part of the carotid* is somewhat

ilar to the above, the operation is, however, more difficult from the sel being deeper, particularly on the left side. The incision should this instance extend lower down over the sterno-clavicular articula- n. The muscles will also require more retraction, and probably some ision. Ligature of carotid in lower part.

Mr. Cock related to me a case, which he authorises me to quote, which Mr. Aston Key applied a ligature to the left carotid for urism, and the man died on the table; indeed, died on the appli- ion of the ligature. After death it was found that the right carotid l been previously obliterated, and the operator had, by ligaturing left, so interfered with the supply of blood to the brain as to se death. Key's case.

Fig. 149.



(This figure, with many others in this chapter, is based upon those given in Sedillot's work.)

With respect to the prognosis after this operation, much depends the object for which it is performed. Dr. Pilz, of Breslau ('Langen- k's Archives,' 1868), makes out that 43 out of every 100 die; Dr. Wyeth, of New York, in a careful analysis of 789 cases, gives 41 per t. Pilz says that of 228 cases in which the operation was performed hæmorrhage, 128, or 56 per cent., were fatal; of 87 for aneurism, or 35 per cent., died; of 142 for tumours, 49, or 34 per cent., died; 71 for extirpations, 25 died, or nearly 34 per cent.; of 34 for Prognosis of ligaturing in common carotid.

affections of the nervous system, only one died, or 3 per cent.; and of 38 for aneurism, on the distal or Brasdor's method, 25 died, or 65 per cent.

Secondary hæmorrhage is a common cause of death, but brain complications are the more frequent—abscess in the brain and atrophic softening from want of arterial supply being the usual form—local gangrene, as it were, of the brain. Brain symptoms in some of their forms also occur frequently after the operation, when death does not take place simply from altered cerebral circulation. Suppuration of the aneurismal sac is not unfrequent; and in a case of my own it was the cause of death.

Ligature of external carotid.

Ligature of the external or internal carotid artery has been rarely performed, the ligature of the common trunk being preferred; but the wisdom of this practice is not very clear. Mr. Cripps has shown in a valuable paper upon the treatment of hæmorrhage from punctured wounds of the throat and neck, that the application of a ligature to the *external* carotid above the superior thyroid artery, or one inch above the bifurcation of the common carotid is the "point of selection" for the application of a ligature. The incision for the operation should be made in front of the sterno-mastoid muscle from behind the angle of the jaw downwards to a point below the level of the thyroid cartilage. The deep fascia and parts over it having been divided, the facial and lingual veins will be seen. These may be turned aside or ligatured and divided if in the way. The artery will be found behind the stylo-hyoid and the posterior belly of the digastric muscle, crossed by the hypo-glossal nerve, with the internal jugular vein and internal carotid artery along its outer side.

The same incision is required for the application of a ligature to the internal carotid artery.

Dr. John A. Wyeth, of New York, in an able Prize Essay, 1878, advocated this view. He shows that out of 91 cases of ligature of the external carotid only 4½ per cent. died, and asserts that the common carotid artery should never be tied for a wound of the external, or one of its branches, when there is room enough between the wound and the bifurcation of the common carotid to allow of the application of a ligature to the external.

In the 'New York Med. Journal,' January, 1874, a case is recorded by Dr. H. P. Sands, of New York, of successful ligature of the internal carotid artery above and below the bleeding point for secondary hæmorrhage occurring ten days after the removal of a cancerous tumour. This operation has been performed four times.

Cervical aneurisms situated on one of the secondary carotids should be diligently treated by compression, and the Hunterian operation only performed when treatment by compression has failed.

Ligature of the lingual artery.

The lingual artery has been ligatured for wounds of the tongue and of the artery itself, to check the growth of cancerous tumours, or to arrest hæmorrhage from their substance. The operation is difficult. The trunk of the vessel is always to be found at a point *above the great cornu of the hyoid bone*, and this point must be rendered prominent by the head being well drawn over to the sound side, and there held. The best incision is horizontal on a level with the hyoid bone, its centre corresponding to the end of the greater cornu. The skin and fascia having been divided, the submaxillary gland will become exposed. On

his upwards and dividing the border of the mylo-hyoid
hypoglossal nerve will be seen resting on the hyoglossus
Beneath this muscle and at a lower level than the nerve, the
be found. It is in close contact with the tendon of the
nuscle. The fibres of the hyoglossus will always require
admit of the ligature being applied. Fig. 150 illustrates
:s.
llent paper on this subject, by M. Demarquay, may be referred
Méd. de Paris,' 1867).

Ligature of the facial artery.

al artery is always to be found in the greater part of its
se to the anterior border of the masseter muscle, where it
vered in by skin, platysma, and fascia; and, at this part,
e or oblique incision at the lower insertion of the muscle
the artery, where it can be ligatured (*vide* Fig. 149). It
to understand under what circumstances this operation
ed for, as the artery can be so readily controlled by pressure,
sure needle and twisted suture over it being the best form
But, where the artery comes off from the external carotid
the submaxillary gland beneath the jaw, it is somewhat
an operation for its ligature by no means easy. I have,
had only one opportunity of practising this operation, and
a lady æt. 25, who was suffering from a cirsoid aneurism of
as it passed through the submaxillary gland. The operation
sful. I saw the case with Dr. Helsham, of Brixton.

Ligature of the temporal artery.

porary artery can always be found and pressed upon in front
n of the ear, over the zygoma. It lies buried in the dense
sue which exists in this spot beneath the skin and fascia, and
y be exposed by a vertical or oblique incision an inch long,
f an inch in front of the tragus.

Ligature of the occipital artery.

pital artery can be traced by a line drawn from the mastoid
the occipital protuberance, and lies beneath the skin and
oneurotic origins of the sterno-mastoid, splenius trachelo-
id digastric muscles, which must be divided to reach the
he deep part of its course. The artery can be felt about the
he line mentioned.

Ligature of the Subclavian Artery.

Ligature of the subclavian artery.

eration in the *first part* of the vessel's course has been per-
elve times, but never with success. It is an unscientific as
unsuccessful operation, and, for disease, it is scarcely a
proceeding, though for a wound it may perhaps be enter-
he insision for the operation would be similar to that for the
.

Place of selection.

nt usually selected for the application of a ligature to the
is in the *third part* of its course, where the artery emerges
nd the scalenus muscle. This operation may be demanded
m of the axillary artery or for a wounded vessel.

On subclavian aneurism.

n may effect the subclavian artery in any part of its course;
olve the whole of the artery, or be confined to its first or
ion. When situated on the artery to the inner side of the

Its seat.

scles, it may be mistaken for an innominate or aortic aneu-
common aneurism may involve all these vessels on the right

side of the body. When affecting the artery external to the scaleni, it is most frequently associated with disease of the axillary artery.

Its diagnosis. *The diagnosis* of subclavian aneurism is by no means easy, and is thus referred to by Nélaton:

"In subclavian aneurism the tumour extends generally externally to the clavicular origin of the sterno-mastoid muscle, reaching the posterior and inferior triangle of the neck; becomes more elongated transversely than vertically; the bruit is propagated more towards the axilla than the neck, and remains the same on compressing the carotid; the radial pulse enfeebled; the limb painful and œdematous, and incommoded in its movements. In carotid aneurism the tumour is seated between the sternal and clavicular origins of the sterno-mastoid muscle, becomes more elongated in a vertical direction than in a transverse one, and on auscultation gives to the ear a *bruit de souffle*, which is propagated more towards the side of the neck than the arm, with diminution of the arterial pulsation in the corresponding side of the face and cranium, and without weakening the radial pulse on the same side. In innominate aneurism the tumour is placed under the sternum, or at the inner border of the sternal portion of the sterno-mastoid muscle, with weakening of the pulse in the subclavian and carotid arteries, and with absence of the other signs peculiar to the two other forms." When a cervical rib is present, and the subclavian artery passes over it, the existence of an aneurism may be simulated; but the knowledge of the fallacy should prevent such an error of diagnosis being made.

Its prognosis. *The prognosis* must always be regarded as unfavorable, for these aneurisms are peculiarly liable to become diffused even in the early stage of their development as a visible tumour; yet there are several instances on record of their slow progress, and, some fortunate examples of their ultimate cure by natural efforts.

Its treatment. THE TREATMENT of these aneurisms is most unsatisfactory, the space at the disposal of the surgeon being so limited that he is at a loss to know where he can attack the disease by a few means that are at command.

Ligature. Ligature of the first portion of the subclavian, ligature of the innominate, the distal ligature of the subclavian and axillary arteries, and ligature of the carotid, have all been performed, and, with one exception, been attended with fatal results. The exceptional case is that of Dr. Smyth, of New Orleans, who tied the innominate and carotid, and subsequently the vertebral artery on the fifty-fourth day. It is only in small aneurisms, occupying the third portion of the artery and the commencement of the axillary, that the operation of tying the subclavian external to the scaleni has been successfully performed, and in some of these instances, the outer fibres of the scalenus anticus muscle have been obliged to be divided.

Amputation. *The amputation at the shoulder-joint* on the distal side of the aneurism has been suggested by Surgeons for the cure of the disease. It has too been successfully performed by Professor Spence, of Edinburgh.

Galvano-puncture. *Galvano-puncture* has been successful in one case by Abeille; and *escharotics* in another by Bonnet.

Manipulation. *Manipulation* has been employed by Fergusson in two cases, and by Lidell in one case, with satisfactory results in the latter one only.

Compression. A case of Porter's may also be accepted as successful. *Direct compression* of the aneurism has been tried by Warren with a favourable issue, although much danger was risked in

the proceeding. Corner's case ('Med.-Chir. Trans.,' vol. lii), though one not actually of the same kind, was a very good instance of the value of preventing an aneurism from enlarging, and exerting such moderate compression as to incite fibrinous deposition in the interior of the sac. Poland's case of successful *pressure on the artery* on the cardiac side of the aneurism is quite exceptional. Gay also has recently met with success. The use of *acupressure* by Porter, though unsuccessful on the distal side of the aneurism, proved fatal when applied on the cardiac side to the innominate artery, and *injection into the sac* was performed in one case with a fatal result. Langenbeck has recently injected the parts over the aneurism with a *solution of ergotin*, the object being to cause contraction of the aneurismal sac. Such is a list of the means which have been resorted to, but the success has never been great. The question naturally arises, therefore, whether we should not discard such measures, and treat these aneurisms on the ordinary principles of internal aneurisms, by rest, attention to diet, and medicinal remedies.

Acupressure.

Injection into sac.

Hypodermic injection.

Mr. Poland, in an admirable essay in the 'Guy's Reports' for 1870, gives a very favorable return of cases which he has been able to collect in reference to this question of treatment. It stands thus:

Statistics of the treatment of subclavian aneurism.

Out of 13 that underwent *general and local treatment* 7 recovered, 1 was relieved, and 5 died; out of 22 cases in which an expectant treatment only was pursued, 4 recovered and 18 died; thereby giving a total of 11 recoveries and 23 deaths, 1 being relieved. Of the 23 fatal cases, the duration of life was noticed in 17.

In 21 cases in which the subclavian artery was ligatured in the *third part of its course* for aneurism, 9 recovered (in 6 of these it was the left artery that was ligatured), and 12 died: 8 of the deaths were due to hæmorrhage, and 4 to brain complications or other symptoms. Poland's facts thus accord well with Koch's, who gives 36 recoveries out of 65 cases, something less than half dying, a success which is in a degree encouraging to surgeons to undertake the operation.

The operation.—It has been already stated that the application of a ligature to the subclavian in the first part of its course is scarcely a justifiable operation; but when undertaken, the incision on the right side would be similar to that for the innominate; on the left side it is scarcely practicable on account of the depth and relations of the artery.

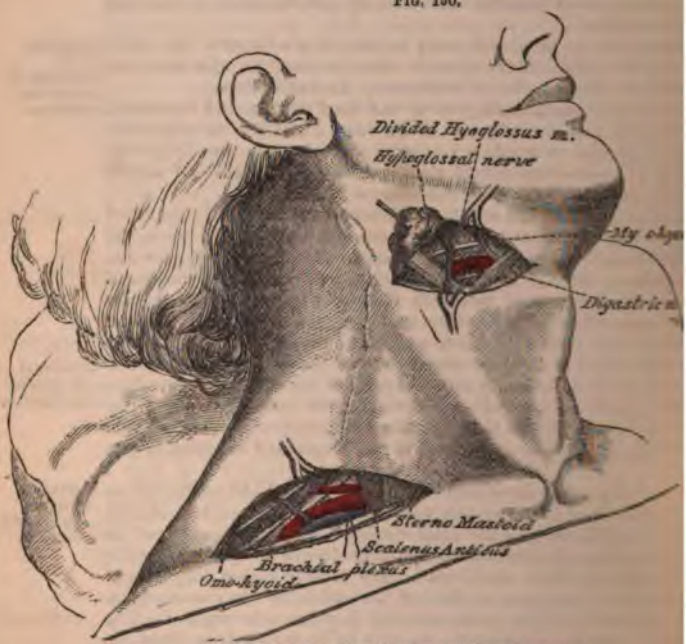
Ligature of first portion of subclavian.

In the *third part* of its course the operation should be performed as follows (the method being similar for both sides). The patient should be raised on a pillow with his head thrown back and face turned to the opposite side, an assistant drawing the arm down as much as possible to depress the shoulder. An incision three or four inches long should then be made on the upper surface of the middle of the clavicle (Fig. 150); not above the bone, as the external jugular vein might then be wounded. Some Surgeons advise the skin to be drawn down from the neck upon the clavicle, so as to diminish this risk. In this incision the skin with the superficial fascia and platysma will be divided. The deep fascia is then seen with the external jugular vein coursing over it. This must be held aside with a retractor. When its division is a necessity, it should be done after the application of two ligatures, one above and another below the line of section. The cervical fascia can *then be divided in the whole extent of the* wound, and this must be done

Ligature of the third portion of the subclavian.

with care on a director. Should more room be wanted, a po
the sterno-mastoid or trapezius muscle may be divided. The
now to be laid aside and the artery looked for in the space
the parts being separated by a director or the handle of the
The vessel will be found just on the outer side of the scalenus
muscle (the edge of which can generally be felt) and beh
tubercle on the first rib, a point which can almost always be m
Several arteries of large size will probably be found crossi
space, as well as many veins. The supra-scapular artery and v
always be seen behind the clavicle. The brachial plexus lies ab
behind and the subclavian vein in front and below the subclavian
When the vessel is seen or felt, the sheath is to be opened
aneurism needle passed around it from above downwards, ca
taken not to injure the vein or include a nerve.

FIG. 150.



Ligature of subclavian and lingual arteries.

Ligature of the axillary artery.

Ligature of the Axillary Artery.

This is a rare operation, although it may be demanded for
wound of the vessel, or, for aneurism of the brachial. It may be
formed in two positions, either immediately below the clavicle, o
the axilla.

The subclavicular operation.

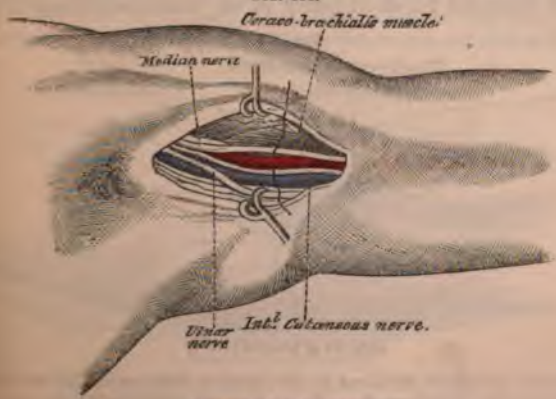
The subclavicular operation is carried out by an incision made

diately below the bone from the coracoid process to the sternal end of the clavicle, dividing integument and fascia, and carefully avoiding the cephalic vein that runs along the anterior border of the deltoid to join the axillary. The clavicular origin of the pectoral muscle will be divided, and the deep fascia or costo-coracoid membrane covering in the sheaths of the vessels will be then exposed and divided. In this step of the operation, some of the branches of the thoracic acromial artery will come into view, and if wounded, must be secured. The coracoid insertion of the pectoralis minor can also be seen. The fascia covering in the vessels will be exposed, and on laying it open the greatest care is necessary as the axillary vein lies immediately beneath it, while above will be found the vessel resting on the first intercostal muscle. The brachial plexus is above and behind. The axillary vein should be drawn downwards and the aneurism needle passed from below upwards, care being taken not to include the external respiratory nerve of Bell that passes behind the artery. When the vessel has been exposed, the passage of the ligature will be facilitated by bringing the arm down to the side of the body. On the dead subject this operation is not difficult, but the number of veins and arteries that exist in the space must ever render the operation on the living far from easy.

Ligature of the artery in the axilla.

To tie the axillary artery in the axilla, the arm should be well raised upwards, and the course of the vessel marked out slightly posterior to the middle line of the axilla. An incision should then be made along the inner margin of the coraco-brachialis muscle through the skin and fascia for about two or three inches, and the deep fascia exposed. This should be carefully divided to the whole extent of the wound, when the artery with its attendant nerves and veins will come into view. In this stage of the operation, the forearm should be flexed on the arm to relax the parts. The vessel, as a rule, has the median nerve on its outer side and nearer to the pectoralis major muscle, and the vein and ulnar nerve to its inner side. The internal cutaneous nerve is in front. (*Vide* fig. 151.)

FIG. 151.

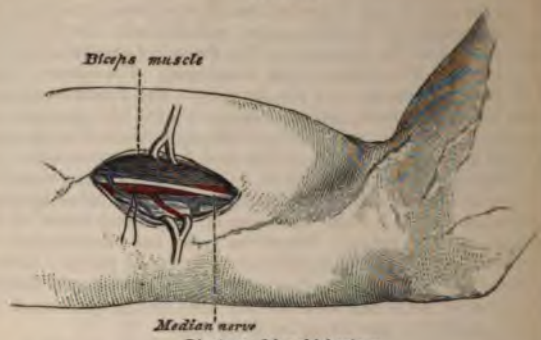


Ligature of axillary artery.

Guthrie's opinion.

Mr. Guthrie condemned the subclavicular operation altogether, advised the Surgeon to expose the artery by an incision three in long, carried upwards along its course, commencing at the l

FIG. 152.



Ligature of brachial artery.

border of the pectoral muscle; yet few have followed this a

Erichsen's views.

most Surgeons preferring the operation named subclavicular, one modifications, or the ligature of the subclavian. Mr. Erichsen fo superior operation prefers an incision made from the centre o clavicle downwards in the course of the vessel to the middle o anterior fold of the axilla, such incision necessitating the di of the great pectoral muscle, and often of the small. He "that this division need not leave any permanent weakness of the as by proper position ready union may be effected between the pa

In all these operations on the axillary artery, the Surgeon must be on the outlook for abnormal division and relations of the vesse

Ligature of the brachial artery.

Ligature of the brachial artery is a very successful operatio may be demanded for direct injury to the vessel, hæmorrhage f

FIG. 153.



Ligature of brachial artery.

wound of one of its divisions in the hand or forearm which cann treated locally, aneurism, &c. It can be performed readily in an

s course. The middle of the arm is the best point to choose. The se of the vessel is indicated by a line drawn from the middle of the a to the inner side of the biceps tendon at the bend of the elbow, e the inner border of the biceps muscle is the guide to the incision. vessel may be exposed by a cut, two to three inches long, made in this tion, with the arm extended and supinated. The skin, which is always , and the fascia should be carefully divided, and the deep fascia which ns exposed ought then to be laid open, but with care, for the basilic lies immediately below it on the inner side of the brachial artery. ulnar nerve will be found on the inner side of the vein, and the lian in front of the artery, but there is no regularity in these tions; consequently much care is required in finding the vessel discretion in tying it, for a high division of the vessel or the tence of some vas aberrans may mislead and confuse. When the t vessel has been found, the application of a ligature is readily cluded. In performing this operation care must be taken not open the sheath of the biceps muscle, and it should be remembered lex the forearm on the arm, after the division of the deep fascia taken place. In several cases in which the occlusion of this ry was required, I have divided it and torsed both ends with excel- t results.

Description of the operation.

Ligature of the brachial in its lower third is now rarely performed. the days of bleeding, it was by no means unfrequently required for matic aneurism, though it has never fallen to my lot to witness its formance for such a cause. The operation may be performed with forearm extended, by making an incision two and a half inches on the inner side of the tendon of the biceps, care being taken to id the large veins that ramify in the superficial fascia. The ten- ons aponeurosis of the biceps will then come into view, and, on its ision, the artery will be exposed with its venæ comites—the tendon the biceps being on its outer and the median nerve on its inner . The forearm should then be flexed after the artery has been osed, when a ligature can be passed without trouble.

Ligature of the lower third.

Ligature of the Radial Artery.—A line drawn from the *outer* side of biceps tendon, at the bend of the elbow to half an inch internal to styloid process of the radius at the wrist, marks out with sufficient

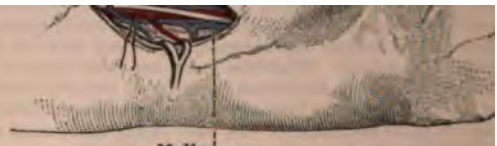
Ligature of the radial artery.

FIG. 154.



Ligature of radial artery.

rness the course of the radial artery, and the vessel may be tied *any part of it. In the upper third of* the forearm (Fig. 154), between



Ligature of brachial artery.

Erichsen's views.

border of the pectoral muscle; yet few have followed most Surgeons preferring the operation named subclavicul modifications, or the ligature of the subclavian. Mr. Eric superior operation prefers an incision made from the c clavicle downwards in the course of the vessel to the n anterior fold of the axilla, such incision necessitating of the great pectoral muscle, and often of the small "that this division need not leave any permanent weakness as by proper position ready union may be effected between

In all these operations on the axillary artery, the Surge be on the outlook for abnormal division and relations of th

Ligature of the brachial artery.

Ligature of the brachial artery is a very successful o may be demanded for direct injury to the vessel, hæmor

FIG. 153.



ulnaris, dividing skin, superficial and *deep* fascia, exposes the vessel, with its venæ comites, and the nerve on its inner side. A ligature can easily be passed round it. The drawings well illustrate these points.

Hæmorrhage from the palm of the hand is always alarming and troublesome, more particularly when caused by a punctured wound. In a superficial incised wound the vessel may generally be found and ligatured or twisted, but, in the case of a deep wound, it is rarely expedient to cut into and explore for such a purpose. Hæmorrhage from the palm of the hand, and its treatment.

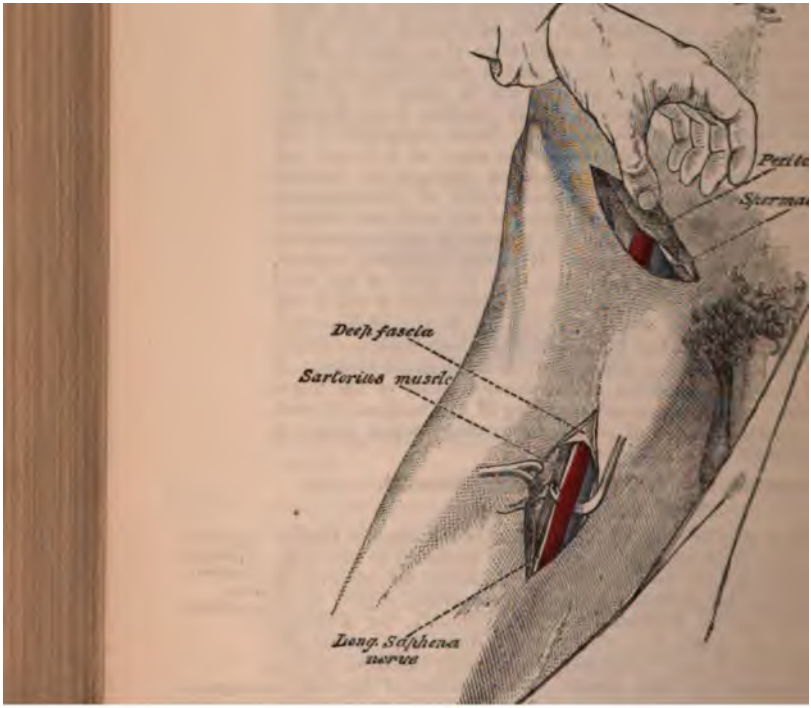
When the vessel cannot be tied, a graduated compress may be applied over the wound and the fingers bandaged, flexed and bound down over a ball or block of wood, the arm being well raised in a vertical position. This dressing should not be undone for at least five or six days. If these means fail, which they rarely do when efficiently employed, the radial and ulnar arteries may be compressed with acupressure needles, and should this prove unsuccessful, the application of a ligature to the brachial artery may be required. In neglected cases where the parts are all infiltrated and boggy, this practice may be called for at once. It is well, however, before resorting to this practice, to try extreme flexion of the forearm upon the arm, with forced supination of the hand, with or without a pad at the bend of the arm; as it is now well known, that by this position the circulation through the brachial artery can be completely arrested; indeed, under all circumstances, whether for injury or disease of the arteries of the hand and forearm in which surgical interference is requisite, it would be well to remember this treatment, it being most effective. It should be known, however, that repeated hæmorrhage may take place from the palm of the hand from the presence of a sloughing tendon. In illustration of this I may mention a very interesting case I had with Dr. Bunny, of Newbury, where a gentleman, æt. 33, had his middle finger bent back so forcibly by a cricket ball as to cause rupture of the integument in front of the extreme joint, and laceration of the flexor tendons of the finger about the wrist. Suppuration and sloughing of the tendons followed, attended by repeated attacks of palmar hæmorrhage, which ceased at once on the removal of the dead tendons. How to apply pressure.

Ligature of Arteries of the Lower Extremity.

The External Iliac Artery.

This operation may be required for aneurism of the common femoral artery, or for any other affection in which it is necessary to arrest the flow of blood through the lower extremity. It should not, however, be performed for any disease unless pressure of the artery, digital or instrumental, has proved ineffectual or is inapplicable, for Mapother ('Dub. Med. Press,' 1865), Eck ('St. Barthol. Hosp. Rep.,' 1866), and Hilton ('Med.-Chir. Trans.,' 1869) have all recorded instances of cure of inguinal aneurism by these means. The operation of ligature is, however, a successful one, and Norris and Cutter give forty-seven fatal cases out of 153 ('Am. Jour. Med. Sci.,' 1847 and 1864). I have performed it on six occasions, and in all with success. The course of the vessel is clearly indicated by a line drawn from the left side of the navel where the aorta bifurcates, to the middle of Poupart's ligament—the upper third of this line corresponding to the common iliac, and the lower two thirds to the external. Ligature of the external iliac artery. When applicable. Statistics of the operation. Course of vessel.

Abernethy, in 1796, was the first to ligature the vessel. The in- Abernethy's operation.


Deep fascia
Sartorius muscle
Long. Saphena nerve

and care should be taken not to injure the peritoneum; the cord which then comes into view should be drawn inwards and the parts held well aside by hooked retractors. With the fingers, the transversalis fascia should be separated from Poupart's ligament and raised upwards with the peritoneum, and the sheath of the vessel exposed, the vein being to the inner side of the artery. The sheath can then readily be opened and a ligature passed, the needle being introduced between the vein and artery. To divide the transversalis fascia, the whole length of the wound, is an unnecessary proceeding; but to deal with it as suggested above is an extra protection to the peritoneum, and in no way renders the operation more difficult; indeed, I have been led to believe, that it facilitates the operation. It certainly does this on the dead subject, and in the eight cases in which I have been called upon to perform it on the living this opinion was confirmed. The genito-crural nerve, which lies upon the vessel, should not be included in the ligature. The operation is only applicable for tumours situated below Poupart's ligament; for others, Abernethy's operation, or that suggested for the common iliac, should be selected.

Ligature of the common iliac.

Ligature of the common iliac artery has been performed about thirty-nine times, but only ten times with success. It was first successfully performed by Mott, of New York, in 1827. I have seen it done but once, and then by my colleague Mr. Cock in 1863, on a man æt. 27, with success.

To expose the vessel, the incision must be long, its length being determined by the size of the aneurism and depth of the artery. A curved incision commencing outside the internal ring and passing upwards and outwards, as if for the external iliac artery, appears to be the best, the muscles being divided to an equal extent. The transversalis fascia must be laid open or torn through and the peritoneum turned upwards. It is at this part of the operation that the greatest difficulties arise, for as soon as the transversalis fascia is divided, the peritoneum covering the intestine bulges into the wound. This membrane also is frequently found adhering to the aneurismal sac, and much difficulty is felt in separating it. This was markedly so in Mr. Cock's case. The oozing of blood into the wound also masks the vessel. The depth of the wound, likewise, renders the application of the ligature a matter of great difficulty. Nevertheless, these difficulties can be overcome by care and good aids. The operation is similar to that last described, though more difficult. In 1846, Mr. Stanley ligatured the common iliac artery by an operation suggested by Sir P. Crampton, and described by Skey.—The patient was placed upon his side, and an incision made from the end of the last rib downwards and forwards in front of the iliac crest, the transversalis fascia was divided, and the peritoneum rolled up. The common iliac artery was then found and tied with apparent facility. On the dead body, this operation is far from difficult, and promises to be of service to the living when the aneurismal tumour is large and high up. Indeed, it is probably the better operation of the two given. The abdominal aorta, too, could be ligatured by the same means. (Fig. 148, page 533.)

Crampton's operation.

Ligature of the internal iliac.

Ligature of the Internal Iliac.—Stevens, of Vera Cruz, in 1812, was the first to perform this operation in a case of gluteal aneurism, occurring in a negress, and the operation proved successful. Since his time, the operation has been repeated eleven times, and in six

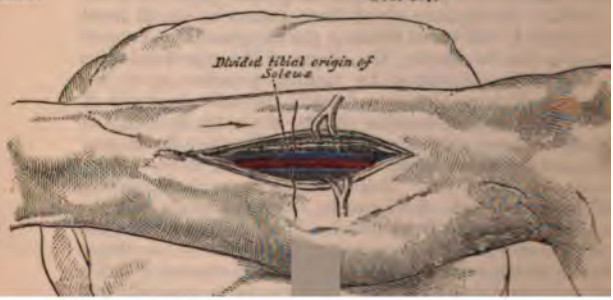
rupture of an artery, or for aneurism the operation is a
as it would be unsuccessful. Mr. Poland has pointed
posterior ligament of the knee-joint is frequently inv
laceration of the vessel. Some years ago I was called
down upon a large needle that had perforated the po
and become lost in its tissues; all movements of the jo
possible by the pricking pain occasioned. I discovere
body lying obliquely across the popliteal artery with its poi
posterior ligament of the knee-joint. The artery was ex
difficulty by an incision made along the outer edge
membranous muscle, the leg being extended. The vein i
ficial than the artery and can always be found to its out
the nerve is still more superficial, and above still furth
lies over the artery at the back of the knee and to its inn
covered by gastrocnemius.

Ligature of the posterior tibial. Guthrie's practice.

Ligature of the Posterior Tibial Artery.

Guthrie brought the weight of his great authority to

FIG. 157.



in the case of the deeply placed posterior tibial and peroneal
ies, and practically carried it out in a supposed wound of the latter
l by making a free incision through the muscles of the calf of the
lown to the wounded artery. Arnott, also, acting on Guthrie's sug-
on, tied the posterior tibial by this method, though neither the
rt of the case ('Med.-Chir. Trans.,' vol. xxix), nor Mr. Arnott's
rks, are encouraging in any way in favour of its repetition; in-
, modern surgeons have universally rejected the method in favour
at which has now been described.

must be premised that the vessel lies beneath the superficial layer
uscles forming the calf and beneath the deep fascia, the nerve
towards the inner side above, but to its outer side, in the greater
of its course. Its course too is indicated by a line drawn from
centre of the popliteal space to a point midway between the inner
eolus and the tendo Achillis.

order to tie the artery, the leg must be partially flexed upon the
and made to rest upon a pillow on its outer side, the heel being
l to relax the muscles. An incision about four inches in length
d then be made about half an inch from the edge of the tibia and
lel with it, through the integument, down to the deep fascia
ing, if possible, any large superficial veins. The deep fascia can
be divided and the muscles exposed. The lower border of the
origin of the soleus muscle should then be looked for, and beneath
director introduced; the tibial origin of this muscle should then
vided the whole extent of the wound. The glistening tendinous
ing of the deep surface of the muscle is an excellent guide to the
l, and should not be mistaken for the deep fascia which lies deeper,
beneath which is found the vessel. To search for the artery, the
ust be well flexed, the heel drawn up, and the muscles retracted.
igature can then be passed in the most convenient way.

the dead subject this operation is not difficult, and on the

Operation on the artery in the middle of the leg.

FIG. 158



Ligature of posterior tibial artery behind inner malleolus.

g, more particularly when performed with the aid of Esmarch's
age, it can hardly be so "difficult, tedious, bloody, and dangerous"
r. Guthrie has described, and as is his own operation.

The operator should be careful, however, not to divide the tibial origin of the soleus too near the tibia, as in doing so he may penetrate the deep fascia, and thus lose his best guide, viz. the glistening tendinous tibial origin of the soleus.

Operation on the artery behind the malleolus.

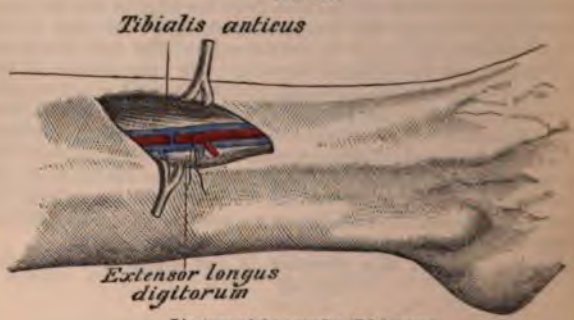
To tie the artery at the *lower third of the leg behind the inner malleolus* is a simple operation. It lies with its venæ comites at the junction of the anterior with the middle third of the space between the malleolus and the heel, the nerve being behind. It can readily be exposed by a curved incision two inches long over the course of the vessel, dividing integument and *deep* fascia, which is thick from receiving many fibres from the internal lateral ligament. The relative position of the vessel can easily be seen in the drawing (Fig. 158).

Ligature of the anterior tibial.

Ligature of the Anterior Tibial Artery.

This operation is far from simple, inasmuch as the vessel lies buried in the upper two thirds of its course between the muscles on the

Fig. 159.



Ligature of the anterior tibial artery.

interosseous membrane; its course is indicated by a line drawn from the inner side of the head of the fibula to the base of the great toe. The surgical guide to the vessel is the tibialis anticus muscle, which *lies to its inner side* throughout its course.

Mode of reaching the vessel.

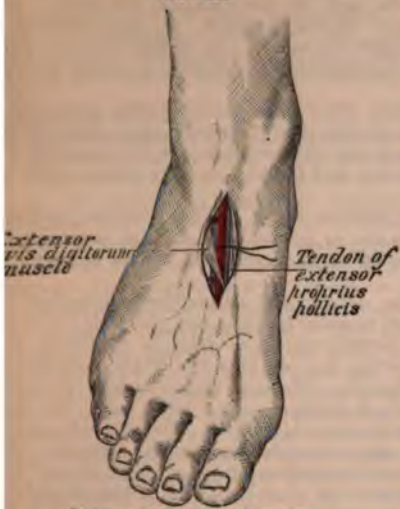
To reach the vessel in the upper two thirds of its extent it is important to expose the intermuscular space separating the tibial muscle from the extensors communis digitorum and proprius pollicis, and the best way to accomplish this is to make an oblique incision four inches long, commencing at the outer edge of the tibia and directed downwards and outwards towards the external malleolus, dividing the integument and superficial fascia. The deep fascia will then be exposed, and the first white line external to the tibia will be found to mark the intermuscular space outside the tibialis anticus muscle in which the anterior tibial artery is to be found. The fascia over this line may then be opened, and the muscles separated, the foot being well flexed to facilitate this measure. The anterior tibial nerve will then come into view, and beneath it the artery will be found. The ligature may be passed as best can be done.

Ligature of Dorsal Arteries of the Foot.

Ligature of the dorsalis pedis artery.

The dorsalis pedis artery should be ligatured to the outer side of the extensor proprius pollicis muscle, by the side of which it lies. The vessel can readily be exposed by an incision made along its course, the integument and *deep* fascia being divided (Fig. 160). It is crossed at its lower part by the tendon of the extensor brevis digitorum muscle, and the nerve lies outside the vessel, while venæ comites attend the artery. The tendon of the last-named muscle is an infallible guide to the artery, as it crosses it, whilst the tendon of the extensor proprius pollicis muscle is the guide to the incision. The surface line of this vessel extends from the middle of the joint of the ankle to the base of the first metatarsal space.

FIG. 160.



Ligature of dorsalis pedis artery.

CHAPTER XI.

INJURIES AND DISEASES OF THE VEINS.

Wounds of veins.

THE blood from a wounded vein is black, flows in a steady stream, never jets out as from an artery. When mixed with arterial d, as occurs when both artery and vein are punctured, it ap- s as a dark band, streaming through a red, or *vice versâ*; the ive thickness of black or red band indicating the extent of the ad in the artery and vein. Pressure on the distal side of a nded vein controls bleeding, whilst pressure on the cardiac side ases it.

Mode of union.

ounds of veins unite as do wounds of arteries, the reparative ess being alike in both. After a clean incision into a vein ir may be so perfect in a few days as to leave no trace of y behind. The lips of a wound in a vein readily unite—as after section, when kept together by gentle pressure, or the application ligature.

Complete division.

completely divided vein contracts, though somewhat less than an y; it also *retracts* into its sheath, and the natural arrest of orrhage is helped by these actions, together with the coagulation

Wounds of deep veins.

Wounds of deep veins, however, are of grave importance the veins are large they are as serious as wounds of la and unhealthy inflammation of the vein with all its follow.

Treatment

Pressure.

In wounds of any of the veins of the extremities well- sure is, as a rule, sufficient to arrest bleeding, and give tim when the trunk of the femoral vein is wounded in oper ligature of the femoral artery, the vein should be divided

Ligature.

a fine prepared catgut ligature. The same should be don tured wound of the internal jugular, or any large vein opening in the vein is now known to be an error. Wounded should be treated on the same principles as wounded art pressure is enough to arrest hæmorrhage from a vein, h the ligature is not required; but when it fails, or is ina ligature may be fearlessly employed. The dread of sett bitis by ligaturing veins is based on prejudice and perience; it is doubtless due to the influence of aut have pronounced against it. It cannot, however, be phlebitis occasionally follows the surgical treatment of it occurs the affection is serious, and takes place only in and cachectic.

Wounds of internal jugular and subclavian veins.

Wounds of the *internal jugular and subclavian veins* and probably more so, as wounds of the carotid or subcl When the internal jugular is wounded near the base of is speedily destroyed, and when near its cardiac end, to hæmorrhage is added that of the introduction of air i When the internal jugular is divided *above* the clavic remains open; the walls not collapsing as they would at tance, owing to their connections with the deep cervical bleeding consequently takes place from the cardiac end, and violent inspiratory act, air may be drawn into the circul the heart, causing death. Hence great care is always re rating about the root of the neck to avoid large veins, an

ath does not supervene from either of these two causes yet
ır from secondary hæmorrhage or from pyæmia.
al incision into the internal jugular vein is not neces-
nded with a fatal hæmorrhage. When bleeding occurs
recurrent. This was well illustrated in a case re-
Mr. Woodman, of Exeter ('Brit. Med. Journ.,' 1873),
he internal jugular vein was ligatured with a successful

ion in Veins.

Coagulation in veins. Adhesive phlebitis.

Phlebitis.—When a vein was found by the older Surgeons by a fibrinous clot, the suspicion of phlebitis was excited, this clot contained in its centre a "puriform" fluid, the inflammatory action was considered to be strong. When s more or less adherent to the inner membrane of the vein, ıembrane presented a pink appearance, the evidence was be complete. At the present day, however, none of these are accepted as true indications of an inflamed vein; as ı that blood coagulates spontaneously in a wounded, lace- ruised vein; that it does so when the venous blood is stopped from pressure upon its walls, or from inflammatory or hanges in the parts around, and that in ill-nourished and ubjects, there is a remarkable tendency for the fibrin of the ecome deposited upon the serous lining of the veins, either lly from some altered condition of the blood, or on the jury, without the existence of inflammatory action.

Indications.

Evidences of an inflamed vein difficult to determine.

osed pus found in the centre of the fibrinous mass is known up of the white blood-corpuscles present in all coagula, while tint upon the serous lining of the vein is due to the mere of colouring matter from the blood, and not to inflammatory

Supposed pus in clot.

ıce formed in a vein rapidly increases, the stream of blood over it depositing fresh layers, until the whole calibre of the ructed; when the process is slow, regular layers of fibrin ı in section, but when rapid the clotting is irregular. At the of the clot, also, like accretions are deposited; the coagula ore or less rapidly in all directions and into all branches, e obstruction, or THROMBOSIS, takes place. This clotting the vein becomes arrested only by the blood stream of a unk. These coagula can readily be removed by washing, emoved, the lining membrane of the vein will generally be al and the valves visible. The coat of the veins at times may kened from contraction, but Mr. Callender has shown, that real but only an apparent condition, the coats of the veins ding to pressure under water. In the process of cure, some- clot will contract towards one side of the vein, thus e blood to pass and the circulation to become re-established. es the blood "may drill for itself a passage through the he clot." In many again the clot will eventually disappear in become patent. Ordinarily, however, a different result , the vein becomes permanently obliterated, the clot and vein contracting so as to form a firm and shrunken cord. In the clot may subsequently organise. Authors have described ıstances of *adhesive phlebitis*. In feeble and cachectic

Tendency of clot to increase rapidly.

Thrombosis.

Thickened coats not real.

Clots may not obstruct entirely.

subjects, however, these curative changes cannot take place. The clot instead of organising will soften and disintegrate, giving place to blood-stained puriform fluid, that may be carried into the pulmonary circulation, causing a lobular pneumonia such as is found in pyæmia from embolism of the pulmonary artery. This was well illustrated in the following case, extracted from the catalogue of the Guy's Museum, No. 1521[55]. Jugular vein exhibiting a wound occupying about half its circumference, and situated about half an inch above the subclavian, the neighbouring branches showing the effects of phlebitis.—James F—, æt. 30, under Mr. Birkett. He received a stab with a knife in the left side of the neck which wounded the jugular vein; much hæmorrhage followed, and continued for some days, when symptoms of phlebitis set in, and he died of pneumonia twenty days after the accident. The vein was found to be wounded as seen in the preparation, its coats infiltrated with lymph, and its interior filled with fibrin. The lungs were filled with abscesses.

Clot may soften and disintegrate and escape into circulation.

Example.

Results such as these, however, do not occur under all circumstances, but only in the feeble and cachectic, for "the clot when softened is usually shut off in an upward and downward direction by newly-added coagula. The softening begins in the coagula last formed, and not, as Virchow states, in those first deposited, for in the advance of the malady the patient's health fails, and the fibrin becomes more and more prone to disintegrate and soften into a puriform fluid." (Callender.) The clot softens also in the centre and not at its periphery, and such cases have been described as examples of *suppuration phlebitis*.

Symptoms of an obstructed vein.

Symptoms.—The most prominent symptoms of an obstructed vein are œdema of the parts below the obstruction, some fulness of the superficial veins, with local pain and tenderness; constitutional disturbance of variable degrees of severity generally preceding. When superficial veins are involved the symptoms may be chiefly local, but in the case of deep veins, constitutional disturbance is sure to accompany local action. Among the superficial veins the saphena of the leg and thigh is most commonly affected, and is often a sequela of a varicose condition. Under these circumstances, the tortuous, dilated, indurated vein becomes a marked object, set as it were in a frame of hardened inflamed skin and cellular tissue. The parts themselves will to a certainty be painful, and the pain and tenderness probably extends up the thigh as far as the groin. Among the deep veins the common femoral or iliac is more frequently involved than any other, and what is known by a "white leg" is due to this affection; it being an œdema of the leg from an obstruction to the femoral or iliac vein, with local pain and tenderness, and more or less constitutional disturbance. In some cases the phlebitis is of a very mild character, and then a good result may be anticipated; but in others it is very severe, and in such suppurative changes will probably take place.

Superficial veins.

White leg.

Deep veins.

It sometimes happens that a limb becomes much enlarged and solid in the deeper but not in the superficial parts, that is, no œdema of the cellular tissue beneath the skin will be present, although the superficial veins may be turgid. The absence of this symptom, however, must not mislead, as it simply indicates that the superficial circulation is

efficiently carried on, and that no stagnation exists sufficient to allow of passive serous exudation.

When these cases proceed favorably the swelling will gradually subside, as will also every other symptom, the vein either recovering its normal condition, or the blood finding its way through other channels. When they go on unfavorably, suppuration will take place, and if the deep parts are involved the case assumes a very serious aspect; as a local or a diffused abscess may result (the latter condition being the more common), and then blood poisoning too frequently ensues with its usual consequences. Progress and result.

Treatment.—The two great indications for treatment in these cases are (1) *to favour the venous circulation of the part, and* (2) *to improve the general condition of the patient.* Treatment.

The first can be attained by elevation of the limb, the foot being raised higher than the hip, and, by the application of warmth to the part in the shape of fomentations or cotton wool. Favour the circulation of the part.

The second can be carried out by the administration of a simple nutritious diet, tonics, such as quinine, bark, or iron, and stimulants carefully adjusted to the wants of the individual case. Attend to general health.

Pain must be allayed by both local and general means, as poppy fomentations, and the internal use of opium, morphia, or chloral.

Leeching should never be resorted to, nor mercury in any of its forms, as the practice was based on a mistaken pathology, and therefore should be discarded.

When suppuration appears it must be dealt with on ordinary principles, as it is wise, as a rule, to evacuate it as soon as it has declared itself. When suppuration occurs.

Gouty Phlebitis.

Subjects who are gouty from hereditary or acquired causes are likewise liable to *adhesive phlebitis*. Sir J. Paget has well described the affection in his 'Clinical Lectures,' 1875; and Mr. Gay has also written ably upon it ('Lancet,' May 19th, 1877):—"In such cases the phlebitis may have no intrinsic characters by which to distinguish it, yet not rarely it has peculiar marks, especially in its symmetry, apparent metastases, and frequent recurrences." Gouty phlebitis.

Like other forms of phlebitis, it is more common in the lower than in the upper extremities, yet it may be found anywhere. It affects, however, the superficial rather than the deep veins, and often occurs in patches, affecting on one day (for example) a short piece of the saphenous vein, and, the next another piece of the same, some other distant vein, or, a corresponding piece of the opposite vein.

The inflamed portions of vein usually feel hard, and are painful to the touch. The soft parts covering the vein become slightly thickened, and often have a dusky reddish tint. When the deep veins are involved, œdema appears with the well-recognised results of venous obstruction, "the limb becomes big, clumsy, featureless, heavy, and stiff; its skin is cool and may be pale, but more often it has a partial slight livid tint, which might be discerned by comparison with the other limb, and has mottlings from small cutaneous veins visibly distended." The limb thus enlarged feels œdematous throughout; but

Fig. 161.



Collateral venous circulation taken from a woman æt. 47 (under the care of Sir W. W. Gull), in whom the inferior vena cava was completely obstructed from cancer. Guy's Hosp. Mus., drawing 44[40].

in the same case of
the popliteal vein b
when taking on th
artery, became muc
thickened, in fact
simply on account
of work it had to pe
new condition; and
cutaneous veins thr
whole of the return
have passed became
larged. An equall
of hypertrophy of v
when any obstructio
of the cavæ or an
trunk, the veno
making its way
channels, which co
large. Thus in Fig
veins of the abdome
seen to be enormo
and hypertrophied
circulation from the
the body to the he
vena cava having b
obstructed from can
The woman, æt. 47,
W. W. Gull, had no
lower extremities a
case, thus proving
of the compensatory
teral circulation, and probably indicating the gradual p
obstruction.

...geons' Museums may be found examples of calcareous degeneration ...other veins. Gay has also described a dissection of a varix which ...pears to have been occasioned by disease, originally atheromatous, ...owed by softening and ulceration of the inner and middle tunics ...the vessel;" and Mr. Pick, of St. George's Hospital ('Path. Trans.,' ...7), has given a somewhat similar example. How far, however, ...s atheromatous and calcareous degeneration is a distinct disease, ... an "after change in some local deposit of fibrin," is an open ...stion.

Varix; Varicose Disease of the Veins and Phlebolithes.

Varix; varicose veins.

Definition.

The term "varicose vein" is unfortunate, as it is applied to any enlarged tortuous vessel, to such as have been already described as hypertrophied veins, and to others that are clearly due to some diseased action resulting in hypertrophy with dilatation. In the sequel the term will be confined to the latter condition. Varix is commonly an affection of the veins in the lower extremities, and mainly, of the branches of the saphena vein. When it involves the submucous veins of the rectum it is called a hæmorrhoid, and, when the veins of the spermatic cord a varicocele. But "all the veins of the body may become varicose," said M. Briquet in 1824. In 1869, a child, æt. 4, was brought to me with a sacculated varix the size of a nut connected with a vein on the outer side of the right forearm: it had been coming on for a year and a half. Taking varix of the lower extremity as a type of the affection, it appears as a disease involving one or more, and in extreme cases all, of the branches of the saphena vein. In most instances it is confined to the larger trunks, in some it spreads to the smaller tributaries.

Examples.

Description of the disease.

In some, however, the affection appears to begin in the capillaries of the skin, and spread towards the larger trunks, and such cases are most common in women. They appear as "clusters of diseased venous radicles" (Gay), and rarely involve other than the smaller branches.

It must not be thought, however, that this affection is one of the superficial veins alone, for such is not the case. Boyer asserted this many years ago, and on his authority, the opinion has been accepted. Verneuil corrected the error, and, in the 'Gazette Hebdomadaire et Médicale,' 1855, showed, that varix is as often a disease of the deep veins as of the subcutaneous—the latter often indicating the existence of the former. He believed, moreover, that the intramuscular veins are sometimes affected without the subcutaneous. Hilton, and more recently Callender, has told us, that the varix of a subcutaneous vein is found wherever the intramuscular veins pass into the subcutaneous, mentioning that "the valves obstruct below, and the column of obstructed, slow-moving blood resist above." Callender has failed, however, to confirm Verneuil's remarks, that varix of the intramuscular branches is constant.

Gay's remarks.

Mr. Gay, an able author on varicose veins (1868), concludes from his experience of many dissections, that "with superficial varicosity there are other serious lesions affecting both arteries and veins, deep and superficial, such as would lead to the conclusion that the general circulation has been subject to a very considerable and long-standing embarrassment, some incompetency of the arterial system or impediment to the venous, or both combined;" and these conclusions are probably correct.

bandage from below upwards should be maintained, or an elastic stocking worn, and, in the course of time, the extent of which greatly varies, a cure may be effected and maintained.

General. During this time, the general treatment must not be neglected. Where the powers are feeble, tonics must be given, and of these, iron is the best; twenty drops of the tincture of the perchloride, with ten of the tincture of nux vomica and a drachm of glycerine in water being an excellent compound.

A generous diet must be given when indicated, and the reverse where the portal system has been overgorged by excess. Mild aperients are always of value under these circumstances, salines being preferable to the purgative extracts. The natural waters are of great value.

Pressure. When rest cannot be given, well-applied pressure must be relied upon, the best forms being a pad of cotton wool over the part with a bandage of Domett elastic tissue or pure rubber, applied from the toes upwards. The patient must be impressed, however, with the necessity of assuming the horizontal position as much as he can, aiding the circulation by friction as already indicated, and by general treatment. The bandage should always be put on before the legs are moved off the bed, and removed only after the recumbent position is again resumed.

In bad cases of local varix, the pressure may be more local and permanent; a pad of cotton wool well fixed on by strapping being very valuable. When the veins are inflamed, they must be treated on principles already laid down in the chapter on phlebitis.

When vein bursts. If a vein burst, bleeding can be controlled by the application of a finger to the spot, and any further flow is prevented by the elevation of the limb. A pad carefully adjusted to the bleeding point and fixed by strapping applied like a bandage or by a roller, makes the patient safe.

Operations for Varicose Disease of the Veins.

Natural obliteration. It has been observed, that nature not unfrequently obliterates a varicose vein by means of a coagulum which subsequently contracts and even organizes, the clot and vein together forming an impervious cord. Acting on this knowledge, surgeons now endeavour to make use of nature's processes, and, by artificial means, to induce coagulation of the blood in some portion of the varicose vessel with the hope that it may contract; or, so to destroy some part of the vein itself as to compel the circulation to find another course. This is the so-called "radical cure"—but it is to be thought of only, as Mr. Gay so truly says, when the vein is hopelessly deteriorated, or so inflamed and painful as to threaten to burst; or, in cases in which all palliative and other treatment is inapplicable or has failed.

Surgical attempts to procure obliteration.

Caustics. **Caustics** were employed by Mayo for this purpose, and also by Brodie, Key, and others. They should be thus applied:—A small piece of Vienna paste (composed of four parts of potassa fusa and four of quicklime, made into a paste with spirits of wine prior to its application), or chloride of zinc paste of the size of a small pea, should be applied upon the vein—the surrounding skin being previously protected by a ring of plaster carefully adjusted; the paste should be fixed on and left, the object being to cause a slough through the tissues into the vein. This slough should not be large, but three, four, or more applications may be simultaneously made about an inch apart, in order

to guarantee success. The caustic may be left for twelve or twenty-four hours and then removed, water dressings being afterwards applied to the part. During all this treatment, the patient must be kept in bed with the limb raised. I cannot, however, recommend this treatment.

Subcutaneous division of vein.

Subcutaneous division of the vein was practised by Brodie, but after some experience, he came to the conclusion, that "it really appears it is not worth patients' while to submit to it."

Excision.

Excision of a portion of the diseased vein has likewise been employed with success, and where an operation is called for, it is doubtless the best. My colleague, Mr. Davies Colley, in 1874 reintroduced the practice ('Guy's Hosp. Rep.,' vol. xx, series iii), which has been followed by myself in bad cases, and others. The operation, which is a good one, consists in the exposure of the varix by a free incision and its removal after the application of a carbolised catgut ligature to the trunk of the diseased vein above and below. Mr. Marshall, in 1875, adopted a like practice ('Lancet,' June 23rd, 1875), taking away some inches of diseased vein with forceps and scissors, after having isolated the portion to be removed by means of pins passed under the vein above and below.

Operation.

Acupressure with subcutaneous division.

Another operation much favoured and practised is that of *acupressure*. It is performed by passing a pin beneath the vein, but not through it, as in Davat's plan, and obstructing the circulation through the vein by means of a twisted suture either of silk, india-rubber, or wire applied round the pin, or, by a piece of thin india-rubber stretched across it on the pin, as suggested by Mr. Lee. Two or even six of these acupressure needles may be inserted about an inch or an inch and a-half apart, according to the extent of the disease. Mr. Lee employs also the subcutaneous division of the vein between the pins at the same time, and my own experience confirms the wisdom of this practice. Mr. Wood employs an elastic steel spring to keep up tension on the ligature till it cuts its way through the vein.

Acupressure with injection.

On several occasions, having obstructed the circulation through the vein as already described, I have injected the vein between the pins with perchloride of iron, one drop being generally sufficient to cause coagulation of the blood; in others, I have used a concentrated solution of tannin; and in all, a good result ensued. The syringe should be that used for hypordermic injections.

Withdrawal of pins.

The time for withdrawal of the pins varies according to the effect intended to be produced. When inserted to induce coagulation of the blood only and not inflammation, they may be withdrawn on the third or fourth day, and, in the practice suggested of acupressure and injection this plan should be followed. Sir W. Fergusson states, "they should be left until they have excited considerable swelling and slight ulceration, and in some instances, where the former is not very conspicuous, they may be permitted to separate by ulceration through both vein and skin. I recommend that the process of inflammation should be more implicitly relied upon than that of coagulation." He adds, moreover, that he has not met with any seriously unpleasant effects out of the numerous instances in which it has been employed.

Fergusson's operation.

It must be repeated, however, that these operations should be practised only in extreme cases and not where palliative treatment is applicable. When a vein threatens to burst, or has burst and endangers life, surgical treatment is justifiable.

Gay on obliteration of the deep-seated veins.

Mr. Gay called attention (Lond. Med. Soc., Oct., 1871) to a class of cases in which the superficial or complementary veins, as he calls them, are obliterated; and, as a result, the return of the venous blood is carried on entirely by the deep veins. These consequently become diseased, the circulation through them grows feeble, and degeneration of the tissues ensues, associated with deep-seated solid œdema of the limb, not subcutaneous œdema, which belongs to obstruction only in the subcutaneous veins. For this disorder exercise, warm applications, tonics, &c., are required; but bandages and rest do harm.

Venesection.

On venesection.

At the present time this operation is very rare indeed, and at Guy's Hospital it is as rare as, if not more so than, amputation. Forty years ago it was one of the most common, and there seems some reason to believe that it will soon be practised again with greater frequency, especially when we find Sir James Paget asserting "that we undoubtedly overvalue the blood, and estimate too cautiously the loss of it;" that "the loss of blood up to fainting and in some cases I remember, with those epileptiform convulsions that come with the loss of blood is absolutely harmless," that is, when performed upon a large series of healthy persons, as was the custom in his student's days. ('Lancet,' Aug. 15th, 1874.)

Fig. 163.



Venesection.—From Heath.

Mode of operating.

It is not a difficult operation, but requires nicety and care. It is usually performed at the bend of the elbow. The first thing the Surgeon has to do is, to render the veins prominent by arresting the circulation through them by means of a piece of broad tape or narrow bandage carried twice round the arm a few inches above the elbow, and tied in a bow, but not tight enough to stop pulsation in the arteries (Fig. 163). He then selects the vein, the largest being the best. Where the outer vein or median cephalic is of good size, it should be chosen, as the inner or median basilic lies immediately over the brachial artery; either, however, may be selected, care being observed not to go *through* the vein. He should also assure himself

that no malposition of the artery exists, as many cases are on record where a superficial artery has been opened for a vein.

The vessel then having been selected, the surgeon should stand in front of the extended arm and hold it with his left hand, the thumb being fixed on the vein below the spot which is to be opened. With his right hand, an oblique incision, not a puncture, should be made through the skin into the vein, describing with the lancet a semicircular movement. The bleeding basin having been brought close to the arm, the surgeon's left thumb may be removed, and the stream of blood allowed to flow. If this be feeble, the patient may be asked to grasp a stick and put the muscles of the forearm well into action.

Fig. 164.



Mode of closing wound.

After venesection.—From Heath.

The required amount of blood having been withdrawn, the tape can be removed, the left thumb of the operator being applied to the wound, and the parts cleansed. A pad of lint is then to be placed over the incision, the edges of which are to be kept well in contact, whilst the thumb is slipped downwards to allow of the adjustment of the pad, which is to be fixed by a figure-of-8 bandage (Fig. 164). The arm should then be slightly bent, care being taken that the pad does not slip during this process.

On the second or third day, the pad may be removed, the wound having probably by that time healed.

Opening the external jugular vein is sometimes called for, particularly when venesection is required in a child, and that part of the vein where it passes over the sterno-mastoid muscle should be selected. The vein can be steadied and rendered prominent by the left thumb of the Surgeon applied at the root of the neck above the clavicle, or this may be done by means of a pad. It then is to be opened with the lancet by an incision made in the course of the sterno-mastoid muscle, and consequently across the platysma. Blood will then flow freely; and when enough has been taken the wound should be closed by means of a pad carefully adjusted. The thumb, which hitherto has been acting as a compress, may then be removed. The pad should be fixed by good strapping.

Operation on the external jugular.

In both these operations of venesection, if the wound in the skin be made smaller than that in the vein, or the position of the arm be changed, a blood tumour or thrombus may form from the escape of blood beneath the integument; and if this interferes with the flow of blood, instead of reintroducing the lancet, the best practice is to

Avoid causing a thrombus.

untie the arm and apply a pad to the wound, opening a vein in the other arm.

In fat subjects there is occasionally some difficulty in finding a vein. Friction of the surface of the forearm will at times help the surgeon, or, the application of a hot flannel round the arm, which should be made to hang down by the side of the body. When these means fail and venesection is imperative, a vein of the foot may be opened.

Avoid air entering the vein.

In opening the jugular vein, great care must be taken not to admit air into it by the removal of the thumb during the operation and until the pad has been adjusted, otherwise life may be endangered.

Gross, Dr. S. W., 'American Journ. of Med. Science,' 1867 and 1871.—*Callender*, 'Holmes's System of Surgery,' 3rd ed., 1883.—*Travers*, 'Surgical Essays,' 1818.—*Langenbeck*, of Berlin, 'Archiv für Klinische Chir.,' 1860.—*Arnott*, 'Med.-Chir. Trans.,' vol. xv, 1829.—*Lee, Henry*, 'Disease of Veins,' 1886.—*Greene, James S.*, Dorchester, Mass., 'American Journ. of Med. Science,' 1864.—*Gay*, 'Varicose Diseases of Leg 1868.

THE SURGERY OF THE DIGESTIVE ORGANS.

CHAPTER XII.

AFFECTIONS OF THE LIPS, MOUTH, TONGUE, PALATE, AND TONSIL.

Wounds of the Lip.

Wounds of the lip.

Under all circumstances these wounds should be well cleansed from dirt, foreign bodies and blood, and then carefully brought together by sutures, which should be deeply inserted and removed on the second or third day. Plaster, as a rule, is not required. Superficial wounds in the inside from the teeth may be left to granulate. When much bleeding exists the Surgeon should examine the part with care, as Erichsen adduces a case in which from the coronary artery so much blood was lost, swallowed, and brought up again by vomiting, as to lead to the suspicion of some internal injury.

FIG. 165.



Congenital fissure of lower lip and jaw with tongue in fissure. Dr. Thorndike's case.

Congenital Fissures of the Lips.

Fissures of lips.

These occur more frequently as harelip than in any other form. Sir W. Fergusson has, however, quoted three cases in his 'Practical Surgery,' in which the fissure extended from the angle of the mouth, in one case to the malar bone, in the second towards the angle of the jaw, and in the third to the base of the lower jaw; and from a case reported in the

'Med. and Surg. Reports' of the City Hospital of the City of Boston, United States, 1882, it seems that the lower jaw and soft parts over it may be fissured in the median line (Fig. 165). In the case recorded, when the patient, æt. 20, opened her mouth, the two halves of the lower jaw protruded laterally like horns and presented a large cavity, and the tip of the tongue was bound down to the tissues in front of the hyoid bone. Dr. Thorndike, who reports the case, closed the fissure by first dissecting up the tongue from its adhesions, and uniting the bones and soft part by a plastic operation.

Harelip.

Harelip. How occurring.

This congenital deformity is due to a want of union between the natural centres of development of the upper lip. Thus the upper lip is made up of a central and two lateral portions, the central being connected with the intermaxillary bones, and the lateral, with the superior maxillary (Fig. 166). A want of union between the central and lateral piece on one side gives rise to simple harelip; a want of union between the central and lateral pieces to double harelip.

FIG. 166.



Showing the development of the intermaxillary and maxillary bones.—From Fergusson.

When the fissure is central—a very rare condition—the intermaxillary bones are either absent or divided. A specimen of the former exists in the Museum of the Royal College of Surgeons, London, and a drawing of a like case taken from a patient of my colleague, Mr. Howse, is seen in Fig. 167. These fissures may be partial or complete, and may involve the skin alone as also the bone, and the latter in variable degrees.

FIG. 167.



Central fissure of lip with deficiency of intermaxillary bones. Mr. Howse's case.

Congenital cicatrices are occasionally met with in the upper lip (*vide* Fig. 47), along the line of union of the central with one or other lateral portion. Fig. 168 was taken from a patient with this imperfection, and in her case there was a slight elevation of the mucous margin of the prolabium, which may be said to be the very earliest indication of a harelip; the child of this woman had a complete fissure. In more complicated cases, the cleft will extend through the alveolar process in a line corresponding with the labial fissure Fig. 169A; in others it will involve the hard palate; while in a still worse class both hard and soft palate will be fissured.

FIG. 168.



Congenital cicatrix.

FIG. 169.



Harelip as slight notch.

FIG. 169A.



As deep fissure on right side.

In a small percentage of the cases—about a tenth—the harelip is

May be double.

double. In these it is not uncommon to find a double fissure extending through the palate; the two superior maxillæ with the skin having failed to unite with the intermaxillary bones. Under these circumstances the intermaxillary bones will often project, covered with a small flap of skin, and at times even stand out from the tip of the nose. In a rare case (illustrated in Fig. 171), the fissure involved the lip and intermaxillary bones alone, the maxillæ being complete.

This affection is more frequent on the left than on the right side of the mouth, and is more common in males than females, while in the more complicated examples this disproportion becomes more striking.

Fig. 170.



Uncomplicated double harelip.

Fig. 171.



Complicated with fissure of alveolus and projection of intermaxillary bone, the palate being perfect.

Thus, in an analysis of cases to be found in my 'Lettsomian Lectures on the Surgical Diseases of Children,' 1863, four fifths of the bad cases were in boys, those of double harelip almost always being found in the male sex.

Treatment. Time for operation.

Treatment.—When ought a child with harelip to be operated upon? Sir W. Fergusson says, "I am of opinion that the earlier the operation is performed the better—assuredly before teething;" and the majority of Surgeons would support this opinion. Judging from my own experience I am not disposed to coincide altogether with this view, for in my analysis of cases at Guy's Hospital a larger number of failures followed the operation when performed during the first few weeks of life than after the third month. In healthy infants it is probable that success may attend the operation whenever undertaken; but in the more feeble it is equally probable that success will be more certain at a later than at a very early period. Under these circumstances I always advise the operation to be postponed until after the third month; that is, when no necessity exists to hurry on the operation, such as inability to take food, &c. On account of this last-named condition I have operated with complete success on the fifth day.

How to hold the patient.

The position of the patient is important. If an infant, the whole body and arms should be bound round with a good towel, and the head fixed by the hands of an assistant placed on either side. The child should be firmly held in a nurse's lap, in the sitting posture (Fig. 172). In other cases the child's head may be laid on the Surgeon's knees, the body on the nurse's.

If an older child, the semi-recumbent position should be chosen, with the head raised on a pillow and fixed as directed above.

The operator may sit or stand behind the patient when the recumbent position is selected, or at one side if the patient be sitting.

Fig. 172.



Chloroform.

Objects.

Essential point to observe.

The Operation.—Anæsthetics may be given without fear in such cases, although in uncomplicated examples the operation is so expeditiously performed as not to render it essential.

The Surgeon has in the operation two main objects in view, viz. to pare the edges of the fissure, and to adapt them so as to render the deformity as slight as possible. But before this an important preliminary step demands attention, and on it the success of the case materially rests, it is to freely separate both sides of the lip from the alveoli; and, when the nostril is widely expanded, to freely separate also the ala nasi from the bone. The object of this step is to allow the soft parts to move freely over the bones, and to be brought the more readily into apposition. Some save the true frænum and divide all other adhesions; but I see no necessity for this practice. To pare the edges of the cleft the knife should be employed; such an instrument making a cleaner section than scissors, and this cleanness of the incision is a point of importance. With respect to the form of incision, numbers have been devised, but most Surgeons fall back upon the old-fashioned straight one above the prolabium, commencing at the apex of the cleft and ending at its free border, care being taken to cut off a good piece. The plan I always follow when the knife reaches the red border of the lip is to turn its edge obliquely towards the cleft, thereby saving a portion of the mucous covering of the lip, and lessening materially the notch in it (Fig. 173). The incision having been made, and all bleeding vessels twisted, the Surgeon should proceed to adjust the parts, and he had better commence at the free margin. When pins are used they should be fine, with flat heads, and one should be introduced about a third of an inch from the margin of the wound, and brought out just under the mucous lining of the lip, reintroduced on the opposite side, and passed through the lip. The edges can then be brought together by means of a twisted, well-oiled suture, care being taken to adapt accurately the parts at the red margin of the lip. If this end be attained, the second and third pins should be inserted above, one close to the nostril, the second between the two, and both fastened separately. If the interrupted silk, gut, or horsehair suture be employed instead of pins, a practice I greatly prefer, having given up pins in simple cases, it is wise to introduce a needle as the first pin to adjust the parts, and then insert the second and third stitches, putting in afterwards the marginal suture by simply drawing the needle that had been introduced as a pin through the flaps. In most cases it is serviceable to insert a fourth suture into the red

Mode of operation.

Fig. 173.



Operation for single harelip.

Use of pins.

Use of sutures.

border of the lip itself. The button suture (Fig. 8) may be used instead of the above, if preferred.

Hainsby's truss.

Fig. 174.



Hainsby's truss.

After the operation, Hainsby's truss should be employed when possible (Fig. 174). It keeps the parts well together, and prevents any traction upon the wound. It is a valuable instrument. When it cannot be obtained the cheeks should be well drawn forward, and held by some good plaster, applied either from ear to ear or from the temple on one side beneath the chin to the temple on the other. The sutures or pins may generally be removed about the second or third day at the latest, and after their removal the cheeks must be held forward by strapping.

Collis's suggestions and mode of operating.

Mr. Maurice Collis, in 1866 ('Dub. Quart.'), in an able paper on harelip, among other points laid great stress upon the propriety of utilising the parings. He never threw away a particle of them, but used them all. I have followed his suggestions in many cases with admirable success, and am disposed to think that where the lips are thin his method is of service. His operation is as follows:—He first made an incision from A to B (Fig. 175), through the thickness of the lip down to the mucous membrane, but not through it, and turned the flap back. On the other side he transfixed the lip at C, and separated the flap as far as D, dividing the flap in the centre at E. He then brought the two sides together by fixing the upper flap C E by a suture to A, and the lower flap E D to B. "Two intermediate sutures being applied (Fig. 176), I thus obtain," says Collis, "a lip nearly double in depth what I could possibly have got by the ordinary incisions"

Fig. 175.



Fig. 176.



Collis's operation for harelip.

Malgaigne's operation.

Malgaigne's operation is, in a measure, somewhat similar to the above, utilising as it does the flaps of skin by turning them down and stitching them together (Fig. 177). In some cases one of the pared edges may be left attached and united with the opposite side that has been sloped to receive it. This suggestion I had from Mr. Dix, of Hull, in 1869. ('Med. Times and Gaz.,' July 2nd).

Operation for double *harelip.*

Double Harelip.—When this is uncomplicated with bone displacement it can be dealt with as simple harelip. In a general way it is

well to operate on both sides at once, more particularly if the lower flaps of the lateral portions are utilised by being turned down and united beneath the central piece (Fig. 179). If there be, however, much separation, and, consequently, traction upon the lateral portions, the operations upon the two sides should be performed separately.

Fig. 177.



Malgaigne's operation. From Holmes.

Mode of dealing with the projecting bone.

When the intermaxillary bones project to any extent, and are separated from the maxillary, there will be some difficulty in the treatment. I believe the better plan is to remove them with the knife or scissors, for when broken and bent back the central incisor teeth too often grow in some abnormal position, and are in the way. When removed, the maxillary bones subsequently approximate, and the lateral incisor teeth frequently assume the position of the central. Sir W. Fergusson latterly removed these bones, or the milk tooth with its bony bed, subcutaneously, and, I think, with advantage. When they are pushed so forward as to form a kind of appendage to the tip of the nose, as seen in Fig. 180, they ought to be removed. The portion of skin over the bones, however, must always be utilised, either to form a columna nasi where none existed, as in Figs. 181 and 182, or to be brought down and inserted between the two lateral portions of the lip.

Fig. 178. Fig. 179.



Operation for double harelip.

Utilise central skin.

When primary union fails, the Surgeon can often succeed in securing union by the third intention by scraping the surface of the wound and re-applying the sutures; and he may do this, although the parts have sloughed at first, as soon as healthy granulations appear.

Fig. 180. Fig. 181. Fig. 182.



Before operation. Front view. Side view. After operation.

Cheiloplastic Operations.

These are demanded for deformity of the mouth from destructive ulceration or sloughing, as from cancrum oris, and are somewhat similar to those for harelip. When undertaken for contraction of the mouth, the Surgeon should always try and turn up some portion of the mucous membrane from within the mouth, to cover over the new angle, and thus prevent its subsequent contraction. I have done this in several cases with gratifying success, one of which is figured Fig. 183.

Cheiloplastic operations on lip.

The deformity was the result of sloughing after fever. At times new tissue must be brought up from the chin or down from the cheek. In-



Fig. 183. Deformity result of sloughing.



Fig. 184. After first operation.



Fig. 185. After second.

deed, these cases tax the ingenuity of the Surgeon to the utmost, since no general rules can be laid down regarding them, each requiring to be dealt with on its own merits. But this much may be said, that no part of the body heals so rapidly or so well as the face, and in none are plastic operations more satisfactory.

Cancer of the Lips.

Cancer of lip.

Period of life.

This term is generally applied to epithelioma or cancroid disease, true cancer or carcinoma being very rare. It is a disease of middle life, four out of five cases attacking patients between forty and sixty years of age. The youngest subject I have seen affected by it was a sweep æt. 27, and the oldest also a sweep æt. 86. It affects the lower lip more frequently than the upper in the proportion of 25 to 1. In my own table of fifty-four consecutive cases, three instances were found in women, to fifty-one in men.

Position.

Sex.

Causes.

Smoking, or rather the irritation of a pipe, has generally been ascribed as a common cause, and it is probable that such an irritation is sufficient to set up the disease when a predisposition to its development already exists. It is interesting to note, however, that nine out of fifty-four consecutive cases in which I made the inquiry, had never smoked, and this proportion is probably, about that of the non-smokers amongst the male population in this country.

Origin and progress.

Fig. 186.



Extreme example of cancer of lip.

The disease generally commences as a dry scab on the red margin of the lip; and it may be that this scab forms over a crack or excoriation, but as often as not it appears alone; occasionally too it commences as a wart. In its early stage the progress of the disease is generally very slow, and only when some ulcerative action appears does it develop more rapidly. It is under these circumstances that the patient first applies for advice, the disease in the dry stage is passed by unheeded.

Appearance of an epithelial cancer.

The appearance of an epithelial cancer is tolerably characteristic (Fig. 186); it has generally an irregular warty aspect, but, when ulcerating, has thickened everted edges. It has always a well-defined indurated base. When ulcerating, it discharges a sanious pus containing epithelial scales in abundance, and when dry, it is covered with a scab of the

same material. Microscopically it contains epithelial elements arranged in capsules. (*Vide* Fig. 42.)

Multiple cancers.

In its early stage it should be regarded as a local disease. It rarely affects more than one part at the same time, but I have seen several cases in which two separate centres existed, and one in which there were three. In the latter, two growths on the lower lips were excised, and nine years subsequently a similar disease attacked the tongue, which I removed in June, 1870.

Enlarged glands.

When the ulceration stage has set in, and the disease has been left to run its course, the glands beneath the jaw will probably become affected, and the affection will steadily if not rapidly progress until all the tissues with which it comes in contact—integument, gums, bone, teeth, and glands are destroyed. It destroys life by exhaustion and haemorrhage; and may do so by secondary deposits in the lungs or viscera, but far less frequently than does carcinoma. In a case under the care of Mr. Howse, in 1875, the disease spread from the lip to the lower jaw, and along the course of the fifth nerve to the base of the skull and brain, destroying life by meningitis.

Treatment.

Treatment.—There is but one treatment that can be recommended, and that is, the speedy removal of the disease. When once the nature of the case is clear the sooner the growth is taken away the better; and, in doing this, the Surgeon must deal freely with the surrounding parts. He had better err by removing too much than too little of the surrounding tissues. To tease the parts with mild caustics is bad practice, as it merely irritates and rarely destroys the whole growth. Caustics cannot, as a rule, be recommended. Excision is probably the best method. When the disease is superficial, it may be sliced off, leaving the parts to granulate; when it involves more of the lip, a V-shaped piece may be taken out, the two edges being brought together as in harelip. When much of the lip is affected, the whole must be removed, and a new lip formed by bringing up the soft parts from the chin as indicated in Figs. 187, 188.

Excision.

Caustics not advised.

Fig. 187.



Diagram showing the lines of incision for new lip after removal of a cancer.

Fig. 188.



Diagram showing position of flaps when brought up.

Recurrence of disease.

After the removal of the disease, a cure may follow; but in the majority of cases, a return takes place, and generally in the same spot. Similar treatment must again be resorted to, even to a second and third operation, as there seems reason to believe, that, after each operation, a longer interval of immunity may be promised. Thus, a man who

on lip.

and the surgeon should be on his guard not to mistake th
They mostly appear as raised, smooth sores, with bases of
hardness, and are usually attended with considerable
swelling as well as with secondary glandular enlargemen
neither the clinical history nor aspect of such an affect
but make much more rapid progress, and are, moreove
with in younger subjects. When syphilitic, the constit
toms, commonly called secondaries, will mark their true

Hypertrophy of the Mucous Glands of the L

Hypertrophy of the mucous glands.

The mucous covering of the lip is often found to be
elevated or pendulous portions of tissue appearing, one o
the middle line. This condition authors have described as

FIG. 189.



Hypertrophy of mucous glands of lip.

FIG. 189a.



Hypertrophy of lip. Mr. Davie

though the name does not appear to be always correc
moving the so-called hypertrophied mucous membrane,
a number of small granular bodies the size of hemp-see
up of gland-cells, are to be found underlying a healthy
brane. The disease appears, therefore, to be often due

Ranula or Sublingual Cysts.

Ranula.

These are now known *not to be* due to any obstruction of the salivary ducts, submaxillary or sublingual, but to obstruction of one of the mucous glands situated beneath the tongue, such as the glands and ducts of Rivini. They are probably analogous to the mucous cysts of the lip already alluded to, and of the mucous passages generally. They contain a clear, glairy, mucoid fluid, but never saliva. I have the notes of several that were *congenital*. They sometimes attain a large size, and when placed beneath the tongue (their usual position), the salivary duct can readily be traced lying over them (Fig. 191). Sometimes they are multiple, and on several occasions, on opening one cyst, I have seen a second within. When neglected and allowed to increase they may so press the tongue upwards as to prevent the patient speaking, or they may form a large swelling beneath the jaw.

Nature of the disease.

Fig. 191.



Ranula or sublingual cyst, with salivary duct lying upon it. Guy's Hosp. Mus., No. 2295.—Hilton's case.

Within the mouth they appear as semi-transparent cysts beneath the tongue, and they are, as a rule, painless, and merely give trouble mechanically. When opened a glairy mucoid fluid escapes. This operation, however, rarely is serviceable, as the fluid re-collects. The best treatment is, to raise the upper wall of the cyst by means of a pair of pointed forceps or a tenaculum, and with scissors to cut it off. M. Panas, of Paris, has lately injected these cysts with three to ten drops of a solution of chloride of zinc (45 grains to an ounce of distilled water) with success. In large tumours the cavity may be plugged with lint soaked in iodine after it has been freely incised. The application of a seton is at times beneficial, though an uncertain remedy; simple plugging of the cyst was a mode of treatment that I formerly employed till I discovered that the plans above suggested were preferable. It is rarely possible to excise them, as they have no definite walls. I have, however, seen this practice carried out with success.

Character.

Treatment.

Encysted tumours are, however, met with beneath the tongue. I have had two under care, and both I mistook for ranula. The error was discovered only on opening them; and in both, on making my incision, I had to cut through the mucous lining of the mouth over the cyst, and then the cyst-wall itself. From both a cheesy sebaceous secretion escaped.

Sebaceous sublingual cysts.

These tumours, which have nothing to do with ranula, have distinct capsules beneath the mucous membrane, and appear to be sebaceous; they are probably congenital. In the cases I have mentioned the patients were under twenty years of age. In both I pulled out as much of the cyst-wall as I could, dissecting it from its bed, and in one with complete success. In the second a return followed, which called for another

operation, which was crowned by a good result. I have never known any of these cysts require removal from below the jaw. In one of my cases I contemplated this plan, and Sir W. Fergusson and Mr. A. Barker give cases where it was adopted. It is probable, however, that incising and plugging the cyst, to set up suppuration, after evacuating its contents, would be a simpler and equally efficacious practice.

Salivary calculus.

Salivary Calculus.

The salivary ducts beneath the tongue may be obstructed in exceptional cases, from the introduction of foreign bodies, but more commonly from *calculus*. Steno's or the duct of the parotid may be thus affected, but the Whartonian or the sublingual salivary duct is that more commonly involved. When the obstruction is complete patients complain during deglutition of pain and swelling in the corresponding salivary gland; such symptoms, which are clearly due to retained salivary secretion, soon subside on the completion of mastication. In exceptional examples suppuration may attack the gland.

Symptoms attending.

The calculus depicted in Fig. 192 was taken from the sublingual duct of a man by my friend Mr. C. Sells, of Guildford, and weighed 48 grains.

Diagnosis.

This affection can usually be easily recognised on the application of the finger beneath the tongue, the calculus, as a rule, holding a superficial position.

Treatment.

On feeling the stone, the Surgeon may often with his nail tear it out of its bed. I have removed several by this plan when not larger than hemp-seeds. When larger the best plan is incision, the Surgeon being careful to cut through the duct where it seems to be thinnest, and scoop the calculus out of its bed by means of a director or bent probe. These calculi may attain considerable dimensions, even one inch long. On one occasion I broke a calculus to pieces in attempting to remove it from the centre of a suppurating sublingual gland of a man, æt. 42, who had had evidence of its presence for years. He came to me with the parts hard as well as ulcerating, having been told he had a cancer, but a rapid recovery followed its removal. Occasionally after the removal of a calculus from a salivary duct a stricture results, and then the gland under stimulus may inflame and be the source of trouble. I have seen several cases demonstrating this fact. A free division of the duct is then the right treatment to adopt.

Fig. 192. *Nat. size*



Size of calculus.

Stricture of salivary duct.

Salivary calculus, weighing 48 grains.

Salivary Fistula.

Salivary fistula.

When Steno's duct, the duct of the parotid gland, has been obstructed near its orifice in the mouth, or has been opened by a wound or ulceration, a salivary fistula may take place, that is, the saliva, instead of being poured into the mouth will escape upon the cheek. When this affection originates in some obstruction to the duct itself it will commence as a soft fluctuating swelling in the cheek caused by retained salivary secretion; and after a time, usually when the duct has acquired about the size of half a walnut, the swelling will ulcerate through the skin, and clear saliva or saliva mixed with pus will escape. If this swelling

be opened the same result will ensue, and after this the cavity may contract, but the fistula will remain.

Treatment. The only successful treatment of this affection is to establish a free opening into the mouth from the oral end of the duct, which may be effected by passing a fine probe into the fistula through the duct into the mouth. When this can be accomplished through the natural opening all the better, but it is not a matter of much importance, as an artificial opening near the oral orifice of the duct will answer every purpose. The probe should be armed with a piece of thick silk, or three or four threads of fine silk, and drawn through the mouth, the ends hanging from the cheek, and those from the mouth being tied together, the whole acting as a seton to establish an artificial fistulous communication with the mouth. This object will probably be secured in about a week or ten days, when the seton may be removed. The fistula in the cheek will then probably contract and close of itself; but if this does not take place the edges of the fistula may be cauterised by the galvanic or benzoline cautery, and thus cicatrisation be encouraged. The operation may be repeated if required. A plastic operation may be attempted when these means fail.

Cervical salivary fistula. I have known *parotid* salivary fistula follow upon the suppuration of the gland after fever in three cases, the orifice in all being small and placed behind the angle of the jaw. In none of these was there any obstruction to Steno's duct. It was troublesome only from the trickling of saliva during mastication, though to one of the patients, who was a lady, this caused much annoyance. I tried the cautery in one of these cases, but without success.

Parotiditis or "Mumps."

Mumps. This is a simple, although an infectious, disease, having a tendency to get well with simple fomentations of the parts, a saline purgative, and a mild tonic. It generally attacks the young, but I have met with it in a lady æt. 82. Its incubation period may extend over three weeks. It is frequently metastatic to the testicle. When it follows upon a fever it is a severe affection, and not unfrequently passes on to suppuration. Such abscesses spread easily, the deep fascia covering them in forbidding a natural outlet, except by burrowing. As a complication of pyæmia it is very serious. Salivary fistula in the neck may follow in such cases. Professor Crocq, of Brussels, believes this disease is the result of a stomatitis propagated along the duct of the parotid gland to the gland itself.

Parotid Submaxillary Tumours.

Parotid and submaxillary tumours. These have one peculiarity, viz. that they are almost always more or less cartilaginous—the ordinary form of tumour in this region being the fibro-cartilaginous—they, moreover, are mostly encysted, having a peculiar hard, elastic feel and botryoidal outline. They are generally embedded in the structure of the gland, and vary much in their depth; tumours that appear moveable and superficial too often dipping deeply down into the tissues, and thus increasing the difficulty of their removal. These simple tumours may grow to a large size, and stretch the skin greatly over them, and should always be removed; the earlier the better. In removing them the Surgeon should be careful to make *his incision well down to the* capsule, when he will probably be

Mode of removal.

able to enucleate the growth. It is far better practice to do this, even with the application of a little force, than to be too free with the knife, for the facial nerve is generally in close contact with the tumour, and the deep vessels are beneath. He should also always cut upon the tumour, dividing only such tissues as hold it down, taking great care too that the large vessels are, if possible, left uninjured. In deeply-placed tumours this removal by enucleation is still more necessary. When the tumour is large there is always a strong probability that the facial nerve will be divided or injured; hence it is as well to prepare the patient for the fact. Fig. 193 illustrates the situation and external appearance of one of these tumours.

Fig. 193.



Submaxillary tumour.

Cancerous tumours of the parotid.

Cancerous tumours of the parotid are likewise met with, but assume a very different appearance from the last. They are mostly infiltrations of the gland, fixed, diffused, and deep seated; they are, moreover, generally associated with paralysis of the facial nerve differing in this way from innocent growths. In such cases surgical interference is rarely beneficial.

Decision as to removal of tumours.

The difficulty of deciding as to the removal of large growths in this position is very great, and the best guide is their mobility. Sir W. Fergusson, who had had more experience in these cases than any one of modern times, says, "If it were evident that the part slid freely over the subjacent textures, I should not hesitate about using the knife, whatever might be the bulk of the disease," &c.; "but if the tumour seemed fixed, its limits were not clearly defined, or an attempt to move it caused pain, I should not readily be induced to use the knife, however small the mass might be," and I endorse these views.

Affections of the tongue.

AFFECTIONS OF THE TONGUE.

Tongue-tie.

Tongue-tie is occasionally met with, but not a tithe of the cases ascribed are of this nature. It is due to a tying down of the tip of the tongue by the frænum linguæ, which prevents the infant from projecting the organ beyond the gums, thereby interfering with suckling.

Treatment.

It is easily remedied by dividing the frænum perpendicularly downwards behind the gum with a pair of blunt pointed scissors, the point of the tongue being elevated with the finger, or a pair of dressing forceps applied beneath.

Ankyloglossis.

Ankyloglossis.—Under this heading cases of fixed tongue are grouped. In some, the organ is wholly adherent to the floor of the mouth; in others, by bands. Under the latter circumstances, freedom may be given by the division of the bands, but under the former little help can be expected by treatment, although an attempt to raise the organ would be justifiable.

Wounds of the Tongue.

Wounds of tongue.

These are sometimes troublesome from hæmorrhage, but, when the parts are brought together the bleeding as a rule ceases; all bleeding vessels, however, ought to be tied or twisted. I have known death to follow a small wound in a child from the trickling of blood down the pharynx, as well as the larynx, the child dying in the latter case asphyxiated, and all surgeons recognise the danger of slow bleeding after a tongue operation. Sutures should always be employed when gaping exists, and these must be put in deeply to draw the whole thickness of the divided parts together. On one occasion, owing to a neglect of this practice, I had to pare the surface of an old wound that had passed through the half of the tongue transversely, and then bring the parts together. The child was unable to talk clearly on account of the injury; yet after the operation, all was well. Since the introduction of nitrous oxyde gas for dental operations, the element of hurry has had the effect of causing many wounds of the tongue, of the contused kind. They are the result of the forceps of the dentist seizing the tongue, with or without a tooth, in a hasty extraction. On several occasions I have found it necessary to cut off the contused and lacerated flap of tongue. When bleeding is obstinate and the parts cannot be brought together, the cautery or perchloride of iron may be usefully employed. In exceptional cases the ranine artery may require a ligature. Ice in the mouth arrests slight hæmorrhage.

Dentists' wounds.

Congenital Affections.

Hypertrophy of tongue.

Hypertrophy or macro-glossia is without doubt a congenital affection, although in certain reported cases it may not have been observed till the first or second year of life. It is usually an affection of slow growth, and troublesome on account of the mechanical obstruction it causes to deglutition and speech: when the disease has existed for years it produces deformity of the teeth and jaws from the local pressure of the tongue upon the former and the nonclosure of the mouth. Syme published a case in which the tongue projected out of the mouth of a girl, aged 14, for three inches; and Humphry another, in a child, aged 11, in which when the tongue was withdrawn into the mouth as far as possible, the exposed part measured, from the upper lip to its tip, two inches. Many other cases are also on record. As a rule this affection involves both sides of the tongue, but in exceptional cases it may affect but one. The growth is generally painless, and the disease not rarely affects idiots and children with ill-formed crania. In the case, from which fig. A, Plate 195, was taken, the disease was congenital and confined to the right half of the organ. It occurred in a boy who, when six years of age, was admitted into Guy's Hospital, under the care of the late Dr. Thomas Addison, with his tongue protruding far out of his mouth and obstructing respiration. His mother stated that the tongue had been affected ever since his birth, and that he had never been able to articulate distinctly. Whenever he took cold the tongue became swollen, blisters formed upon it, which burst and bled. The increase of the disease had been gradual. He was treated with mercurials, and he derived so much benefit from them that he left the hospital *with the tongue fairly* retracted. He reappeared, however,

Example.

three years later (1856), with the same disease, the growth having rapidly increased for one month before his admission; he then came into the hands of the late Mr. John Hilton. At that time the right half of the tongue with the submaxillary glands was much enlarged, the whole organ was protruding from the mouth, and the papillæ on the affected side of the tongue were much hypertrophied. He was again treated with half-drachm doses of the solution of the perchloride of mercury and left relieved. In another three years the tongue had grown as large as ever, and he was readmitted for the third time, when the tongue presented much the same appearance as it had on his previous admission, although the papillæ seemed coarser. He was treated in the same way as on the two previous occasions, and he left relieved. No further history of his case is known. The drawing (fig. 1, Plate 195, page 594) was taken after his second admission into the hospital.

It should be mentioned that in this case there were no symptoms of the presence of nævoid tissue. The tongue appeared coarse, thickened, and enlarged, as if from simple muscular hypertrophy, and yet from the fact that the enlargement diminished under the influence of mercury, there must be a question as to this being its true nature. Indeed, the case appears pathologically to be like one shown at the Pathological Society in 1872 by Mr. H. Arnott, in which, after its removal, there was visible microscopically very little true muscular hypertrophy of the organ; but the epithelial covering of the tongue was very thick, and the papillæ enlarged; the blood-vessels were larger than usual, and there were large irregular spaces with thin walls, which were filled with blood or clear fluid; a few vesicular bodies, which may have been enlarged lymphatics, were also present. Macro-glossia, as a disease, is, according to Mr. Arnott, probably due to a variety of causes, that is, to (1) a true muscular hypertrophy of the organ; (2) a nævoid affection of its blood-vessels; (3) a thickening and induration caused by a long-continued sub-inflammatory state; or (4) a general enlargement of the lymphatics of the tongue.

Causes of.

Treatment.

The treatment of this affection has hitherto been excision, either of a wedge of tongue, as successfully performed by Humphry, or the removal of the projecting portion of the organ by the knife or écraseur. Good also has said to have been derived from ignipuncture. But mercurial treatment should certainly be employed in some cases before recourse is had to surgical interference, since in the case I have recorded the benefit of the drug was most striking.

In some cases of enlargement, and more particularly when the disease is not congenital but acquired, and consequently probably inflammatory, the effect of the iodides should also be tried. In the following case of a gentleman, æt. 20, who consulted me some years ago for enlargement of the tongue of twelve years' standing, and which I, from its history, regarded as inflammatory, the drug proved valuable. The enlargement was associated with a protrusion of the organ and all the consequent evils. Iodism, induced by ten-grain doses of the iodide of potassium three times a day, was followed by the speedy disappearance of the affection, though at the time death appeared imminent from the excessive swelling of the organ caused by the drug.

I should like to mention that so early as 1807 Sir A. Cooper removed a portion of a tongue weighing on removal 2 ounces 2½ drachms (Troy).

and measuring 3½ inches in length, 3 inches in breadth, and 1½ inches in thickness, from a man æt. 53, who had been troubled with the enlargement for six months. The disease was supposed to have been brought about by the use of mercury given for syphilis. The case did well. Vide Prep., Guy's Museum, No. 1670.

On growing and degenerating Nævi of the Tongue.

These cases are not very common, and out of about half a dozen that I have seen the following is the best. Fig. B, Plate 195, was taken from it. I first saw the case when the girl was an infant, and the tongue presented the appearance and feel of a vascular sponge. The whole organ at that time was swollen, and large distended veins coursed over and under its surface, more particularly on its right side; it had likewise a very full arterial supply. On the application of pressure by means of the thumb and fingers the tongue was readily emptied of its blood, and on its removal, it at once refilled. The case was brought to me for treatment, I advised that nothing should be done, and I did so on the recognition of the fact that nævi have a tendency to undergo degenerative changes, and in the hope that these changes would take place in the tongue. In this hope I was not disappointed, for during the twelve years that passed since I first saw the case many changes took place in the part, and the most typical was the cystic degeneration of the nævus. These changes began when the child was about six years of age, and have steadily continued. At present the tongue has quite lost its spongy feel. In consistence it is tolerably firm, but it feels harder in some spots than in others. To the eye its surface looks to be made up of vesicular warts, these vesicles being filled either with clear or more or less blood-stained serum. In fact the tongue appears precisely as any nævus appears which has undergone the peculiar cystic warty degeneration to which such growths are prone. It has, however, probably less of the papillary hypertrophic growths on its dorsum than many nævi on mucous surfaces show. These appearances are confined to the upper surface of the tongue, for its lower aspect (Fig. C, Plate 195) still presents, in a degree, the venous engorgement which originally characterised the whole growth. Example. Degenerating nævus.

The appearances I have described and illustrated are absolutely typical of a degenerating nævus, since no other growths ever undergo like changes, nor present any like features.

I must mention here a curious *complication* which presented itself in this case, and which is difficult to explain, though I am disposed to think it had something to do with obstruction of the lymphatics. It appeared when the child was ten years of age, and when the cystic degeneration of the nævus had far advanced; it showed itself as a painless swelling of the neck, which began in the right submaxillary region, and descended backwards towards the angle of the jaw, and downwards along the neck. When I saw it there was a soft, flaccid, baggy enlargement of the part, without any external or general signs of inflammation. I looked upon it as cystic, and advised its removal. On attempting to carry out this practice I found no signs of a cyst-wall, but simply a collection of a thin, watery, but highly albuminous fluid in the deep connective tissue of the neck. Indeed, when an incision had been made into the swelling, and the fluid was evacuated, I never saw nor made a more perfect dissection of the submaxillary and digas- Complication in case.

tric spaces than then showed itself. The fluid had clearly been poured out into the connective tissue of these deep spaces, and there was no cyst wall. I washed the cavity out with iodine water and introduced a drainage-tube, and under the kind care of Dr. O'Meara, of Sutton Bridge, Lincolnshire, the case subsequently did perfectly well, and no return of trouble has taken place.

Fig. B, Pl. 195, was taken when the child was twelve years of age, two years after the disappearance of the above complication.

It is quite possible that at the present time the tongue of this child, being large and coarse in appearance, might be mistaken for a case of macro-glossia or one of the forms of hypertrophy. No one, however, who recognises the peculiar cystic appearance of its surface should mistake it or fail to recognise its nævoid origin.

Such cases as this have doubtless been described by authors as examples of vesicular disease of the tongue.

Nævi of the tongue do not, however, more than nævi of other parts, always undergo degenerative changes, although, when they do, they for the most part assume the appearances presented in the drawing, with such modifications as of necessity result from the surface being cutaneous or mucous. Such nævi will probably require treatment.

Congenital Tumours of the Tongue other than Nævi.

Congenital tumours.

These do occur, though rarely, and they may appear as outgrowths, warty or otherwise.

I have seen a warty growth covering the dorsum to the extent of a sixpence, and a growth as large as a rice seed projecting as an outgrowth.

I remember also cutting off from the dorsum of an infant's tongue a pedunculated fibro-cellular congenital growth, the size of a pea, and a good recovery followed.

In removing these pedunculated growths it is well to cut well into their bases, since cases have been recorded in which a return after removal has taken place.

Congenital tumours of a deeper kind may likewise occur, though none have come under my notice. A remarkable instance of such was recorded by Mr. Hickman in the twentieth volume of the 'Pathological Society's Transactions,' in which an infant, sixteen hours after birth, was suffocated by a growth on the base of the tongue, made up of hypertrophied racemose glandular structures normally existing in the part.

Amongst the congenital tumours of the tongue must likewise be mentioned the existence of gummata in the subjects of hereditary syphilis.

Ichthyosis of the Tongue.

Ichthyosis.

This peculiar disease of the tongue, to which the attention of Surgeons was first drawn by Mr. Hulke in 1864 (Clin. Soc., 1868) is now generally recognised, although it is often known as psoriasis. It is met with in several forms. In the *least* common variety the papillæ themselves seem to be hypertrophied, and the disease appears as a coarse tongue, in which the papillæ are very large, and in some cases covered with a dendritic, horny, epithelial covering. In the more common kinds the surface of the tongue wholly or in part assumes, as

the one hand, a smooth and bluish-white appearance, tesselated in a small or large pattern and delicately furrowed, with an absence of papillæ (*vide* Plate 196, fig. G); or, on the other hand, it presents a more or less extensive whitish or yellow raised plaque made up of finer or coarser epithelial elements, with the uniform surface illustrated in Plate 196, fig. I, the parts when wet having a wet white-kid or yellow wash-leather aspect and a harsh feel, and when dry a brown appearance and a horny touch.

Fig. 194.



Papillomatous ichthyosis of tongue.

Forms of disease.

These three forms of disease may well be called, as suggested by Mr. Henry Morris, the *papillomatous* (Fig. 194); *smooth tesselated* (Plate 196, figs. G and H); and *raised plaque* varieties (Plate 196, fig. I page 595).

Subjects.

The disease is generally met with in subjects of middle age, although I have seen it in a woman as young as twenty-two, and it is more common in men than in women. It is in the majority of instances confined to the tongue, but in about one third of the cases the buccal membrane is implicated as well.

Relations to cancer.

It is very frequently associated with cancer, as in four out of the last ten cases I have noted, and in thirteen out of twenty-seven tabulated by Mr. Morris; it is said by some authors always to lead up to it. It may or may not be found complicated with syphilis, but that it has a syphilitic origin can with some confidence be denied.

In one instance I found it associated with elephantiasis arabum of the legs and genitals. It was in a gentleman, æt. 42, who had had the elephantiasis for ten years, and the ichthyosis of the horny type much longer. It is met with in the temperate, but more frequently in the reverse, and it is as often as not found in those who do not smoke. It is a slow, insidious disease, and is rarely recognised except by accident, until it has assumed a very marked type or become the seat of changes which suggest or characterise epithelioma.

Microscopical appearances.

The microscopical features of this disease are somewhat characteristic; they have been well described in the following report, made by my friend Mr. Symonds, of a specimen (Plate 196, Figs. G and H) which was taken from Mr. B—, æt. 64, in 1882, in whom the ichthyotic disease had existed for twenty years, and the cancer for seven months:

"The microscopical examination shows the papillæ to be much wasted, their arrangement resembling more that in the skin than in the tongue.

"The superficial layer of epithelium is very much thickened. The deeper layer varies in different parts. In the drawing the deep part is ill-defined, and the cells are seen with a higher power to become altered, and to be mingled with those of the mucosa. As the epithelioma is approached the limit is more marked for some distance, and the processes are shorter until the epithelial ingrowths are reached.

"Towards the opposite side of the tongue the appearance resembles for some distance that indicated in the sketch. The mucosa is infiltrated with crowds of nuclei. These are particularly abundant at the spot from which the sketch was made; they diminish rapidly towards the epithelioma, but remain fairly abundant in the opposite direction. This diminution of nuclei, with increased definition of the basement membrane towards the epithelioma, is a striking feature in the sections."

Treatment. TREATMENT.—It has been already stated that the majority of the cases of this disease do not come under the notice of the Surgeon until the affection is a confirmed one, and under these circumstances it can readily be understood why the affection has been pronounced incurable. If seen earlier and treated, there is some reason to hope that benefit might be derived from treatment, if not a cure brought about.

This hope is supported by the assertion of those who tell us that they have seen cases of so-called psoriasis (not syphilitic) of the tongue cured, and I am sure that in several examples of ichthyosis I have found arsenic as an internal remedy, boracic acid or chlorate of potash as a local one, and as near an approach to milk diet as possible, with a total abstinence from wines, spirits, and smoking, highly beneficial.

In cases of advanced disease it is difficult to find patients who will submit for a sufficient period to this treatment, but in others, where it is met with in its early stage, the treatment would not be of necessity so prolonged. I am, however, convinced of its value, and would urge its adoption.

Excision. In confirmed disease I know of nothing but the excision of the organ, wholly or in part, that can offer any prospect of effecting a cure, and if the pathological doctrine be correct that this disease always ends in cancer, there can be no difficulty about the course which should be taken. I think, however, at present it may with some confidence be asserted that this positive opinion is "not proven," and under these circumstances, whilst the Surgeon is justified in not rushing into operative interference in all cases, he should so watch the case as to be prepared to take steps for the complete removal of the affected organ as soon as he can see that active changes are occurring in it, or anything like an ulcerative or degenerative change makes its appearance.

If the Surgeon should err let him do so on the side of early interference rather than that of delay, for it must be added that when a cancer attacks a tongue the subject of ichthyosis it usually develops rapidly, and when the disease returns after removal it does so more commonly in the submaxillary or cervical glands than in the part. The return growth, moreover, always displays great malignancy. In the case from which Fig. 1, Plate 196 was taken the disease returned within a year in the neck, and developed as a soft cancer.

Return in glands.

In connection with this subject of ichthyosis of the tongue and its close association with cancer I should like to record the following fact:

In 1879 I saw a gentleman, æt. 57, who was the subject of congenital ichthyosis of his skin, with an ulcer on his foot of six years' standing, which became cancerous and had to be removed.

This gentleman was one of nine, the eight being women, and four of these eight had the same ichthyotic disease. The mother of these nine had the same disease, and her father before her. The gentleman himself was married and had six children, three boys and three girls. Two of the boys were similarly affected.

Inflammation and Suppuration of the Tongue.

Inflammation of the tongue, when deep seated and general, is a grave affection, since the swelling which accompanies it is often so sudden and severe as to threaten life by suffocation. Such cases are, however, rare; I have seen but one. Inflammation of tongue.

I say this, excluding from consideration those cases of sudden enlargement of the tongue, the result of salivation from mercury or iodism, as in a case already reported. In these the symptoms, though severe, as a rule subside rapidly under local treatment and on the removal of their cause.

In rare cases, however, the tongue may slough off after ptyalism.

Inflammation of the tongue, when local, may be acute or chronic. It may follow an injury, or come on without any other assignable cause than cold or exposure. It may begin as a sudden swelling of one half of the organ, associated with constitutional symptoms of fever, &c., or it may show itself simply as a chronic enlargement of the part, with few, if any, general, and no more local symptoms than are to be explained by the mechanical enlargement of the organ.

The disease, however, under both circumstances, is not dangerous, since it is well amenable to treatment, and has a tendency towards recovery. I have seen many examples of this affection, and in all a good result took place.

Treatment.—When acute inflammation attacks the tongue as a whole, and threatens life by suffocation, free puncturing or free incisions made in a vertical direction into the organ may be required,—these openings being made with the view of relieving mechanically the turgid conditions of the vessels and of giving exit to the inflammatory fluids which infiltrate the part. Serious hæmorrhage may, however, at times, follow these incisions, and in a case I witnessed of the late Mr. Poland's the result was nearly fatal. Treatment.

In more local inflammations, the benefit of puncturing the swollen part is very great,—in the early stage to let out the serous fluids, and in the later to let out pus.

By way of medicines salines and tonics are beneficial, but the disease has a tendency to get well by natural processes.

Hydatid Cyst in the Tongue giving rise to Suppuration.

The possibility of a chronic cystic enlargement of a tongue, as of other parts, being due to the presence of an hydatid should always be in the mind of the surgeon; and more particularly when the enlargement is painless, and gives rise to trouble mainly from mechanical causes. Also, when a chronic, painless globular tumour has existed in a part for some time, say months, and then suddenly increases—the possibility of the swelling being due to the presence of an hydatid which has died and given rise to suppuration should be entertained—for hydatid tumours in their early stages, in the tongue as elsewhere, Hydatid in tongue.

give rise to symptoms of a mechanical kind, and at a later peri
they die, to suppuration.

Examples. I have seen two cases of this affection; one occurred in th
of a middle aged patient, who had a chronic cystic enlargemen
side of the tongue. When the cyst was punctured a globular
escaped and a good recovery ensued.

The second case occurred in 1881, in the person of a girl,
who came to me with a *central* cystic swelling of the tongue
or eight months' existence. The enlargement had been quite
and felt like a tight globular tumour embedded in the tongue.

I punctured the swelling with a lancet and evacuated a
hydatid cyst floating in pus, and a good recovery took place.

In the first case related the hydatid was turned out entire
second, the hydatid had died and had given rise, as any fore
might, to suppuration. A cure in both cases took place as so
foreign body was removed.

Chronic Superficial Glossitis or smooth, glossy Tongue.

Chronic glossitis. A smooth glazed tongue is often met with in practice, and
be little doubt as to its being the result of a chronic i
tion of the mucous membrane of the organ. At times it is
with ulceration. This inflammation is in many cases due to
or irritating influence of a hot pipe, cigar, or spirits.

It is well described by Mr. F. Clarke ('Diseases of Tongue
—161). It shows itself in patches more or less oval or obl
deep red colour and raw aspect, the other portions of the to
senting their natural appearance. The surface of these
smooth and glossy, though at times ulcerated. The tongu
occasionally swollen, and where the disease has existed for
the patches feel thickened and as if elevated. Should the
checked in its progress a complete recovery may ensue, but
monly the patches remain smooth and shining, or become the
white patch.

In preparation 1672[5], Guy's Museum, there is an interest
ple of the affection which occurred in a man, æt. 49, who wa
with pemphigus and erysipelas, in March, 1878, and who g
history of syphilis five years previously.

The preparation, as described by Dr. Goodhart, shows
tongue was changed in appearance completely. Its surface,
being rough looking, had lost all its papillæ, even the circ
the whole being scarred over with smooth cicatricial tissue.
cous covering of the tongue was thicker than normal, s
white. At two spots were ulcers, one the size of a threep
with an indolent, unhealthy surface, the other larger and
ficial, healing. The tongue was not fissured.

Microscopically these patches "are either entirely denuded
lium or it is reduced to an extremely thin layer, and the
obliterated by distension. Pathologically the disease "appe
chronic inflammation of the mucous membrane which has
produced complete alteration in the characters of the epid
thickening of the corium and submucous tissue." Butlin, "
Trans.," vol. 61.

The disease is constantly the precursor of a cancer.

Ulceration of the Tongue.

Ulceration and its varieties.

clinical point of view it is expedient to divide the ulcers of the into the *superficial* and *deep*—since in a general sense the super- are local, simple, and readily curable; whereas the deep—which to the breaking-down of inflammatory, tubercular, syphilitic, erous elements—are complicated, difficult to diagnose and treat, reover are dangerous.

superficial sores include the aphthous and dyspeptic ulcers; sociated with chronic glossitis; ulcers excited and kept up by or ragged teeth, as well as some due to syphilis, congenital or d.

deep ulcers are always either syphilitic, cancerous, or tuber-

Superficial Ulcers.

Aphthous ulcers.

ordinary *aphthous* inflammation of the tongue is a common m, and is met with in children and adults as a result of irrita- the stomach or intestines from dietetic or other causes. In subjects the white aphthous spots may ulcerate and thus become re of much trouble, and the ulceration may be extensive though deep. In cachectic patients the parts may slough.

treatment of these cases must be mainly determined by the but in the majority, a lotion of chlorate of potass, or boracic five grains to the ounce of water, and the internal administra- the same drugs with or without bark or the mineral acids, is ly sufficient to bring about a cure, though in feeble subjects this slow.

more limited affection, the local application of the nitrate of ften acts very beneficially; and in the more chronic, quinine is value.

The Simple or Dyspeptic Ulcer of the Tongue.

Dyspeptic ulcer.

form of superficial ulcer of the tongue may be the sequel of thous, but more commonly it begins as an ulcer, a result of glossitis which steadily spreads. It rarely, if ever, dips into cular tissue of the organ, but is confined to the mucous mem- overing it. The ulcer may be inflamed, indolent, sloughing, or , indeed, it may vary as may any ulcer in another part of the nd if chronic it will be indurated. Its surface, however, will always be smooth, and it will never display the irregular, or deeply- ed appearance of the deep sores—it will, moreover, almost be seen upon the dorsum of the tongue, although in exceptional es it may spread downwards.

Treatment.

tment.—The only sound principle of treatment is a soothing d the chief good is to be gained by means of diet. This is to lated in the most careful manner, and all food should be for- that can possibly irritate. Milk food, when it can be taken, is t, and with it, it is well to give alkalies, such as lime-water, nate of potash or chlorate of potash, and at times opium in loses. Animal broths are beneficial—but little meat should be l. All beer and spirits should be interdicted, and when stimu- are absolutely necessary they should be given as wine well

DESCRIPTION OF PLATE 195.

FIG. A.—Hypertrophy of tongue.

FIG. B.—Nævus undergoing cystic degeneration.

FIG. C.—Under surface of degenerating nævus of tongue.

PLATE 195











[redacted]

PLATE 196









DESCRIPTION OF PLATE 196.

G. F.—Cancer in tongue, seat of syphilitic disease.

G. G.—Cancer in tongue, the seat of ichthyosis of the tesselated variety.

G. H.—Section of cancerous and ichthyotic tongue.

G. I.—Tongue, subject of ichthyosis of the raised plaque variety.

Locally the lotion of boracic acid or chlorate of potass is bene and caustics are rarely required. Of tonics the barks are the form, but at times the mineral acids are of value.

Ulcers Originating from Local Irritation.

Ulcers from local causes.

These are very common in the tongue, and the fact is due t restless mobility of the organ, and the necessary friction which it receive from any sharp process, of a broken or decayed tooth, or edge of rough tartar, or even from the presence of an exostosis o lower jaw. I have known an ulcer due to the last cause to be lo upon as cancerous.

These cases are at times very troublesome and obstinate unless cause is recognised, and they may, and do, without doubt, often be cancers.

They may show themselves as mere blisters, or superficial ulc the other part of the tongue being healthy—but in chronic case local sore may be indurated and thus simulate a cancer. In the of a woman aged 40, the ulcer had existed two years.

Some subjects are more susceptible to irritation than others, a have known a patient have repeated blistering and ulceration o tongue from the irritation of a rough decayed tooth after sle on the affected side. The mere weight of the tongue against the t and the unconscious friction between the two parts when in co proved enough to produce a blister in the soft parts.

Treatment.—The mere knowledge of the cause of this affe suggests the remedy—namely, the removal of the cause—the rem of the point of irritation when possible, and the extraction o tooth when nothing less is sufficient. Indeed, as a general of practice the Surgeon should always advise the removal of local source of irritation from the tongue as from any other pa the body—for such is without doubt the cause of the majorit local cancers.

Infiltrations and Deep-seated Ulcers of the Tongue.

Deep ulcers.

I have of necessity grouped these cases together, for the majori the deep-seated ulcers of the tongue begin as local infiltrations are due to the subsequent breaking down of the infiltrated and trating material.

The group consequently includes cases of syphilitic disease, of ep lial cancer, and of tubercular disease of the tongue, each of w claims a distinct notice.

Syphilitic Disease of the Tongue.

Syphilitic.

This shows itself in many ways and under many circumsta Thus it may occur as a *congenital affection*, and appear either mucous patch on the tongue associated with other constitutional s ptoms, or as a deep fissure as recorded by Dr. Barlow ('Path. Soc. Tr vol. 31), or as a superficial ulceration. Of the former kind I have several examples; of the latter but one, and that through the kindn of my colleague Dr. Goodhart, in whose practice it occurred.

A full report of the case may be read in the 'Guy's Hospital Report for 1883.

As an acquired disease, syphilitic disease of the tongue shows itse

either as a mucous patch, or as a more or less extensive local infiltration of the tongue with gummous deposit, the breaking down of which leads either to superficial sores or to fissures (*vide* Plate 195, fig. E), or to deeply excavated irregular ulcers, and later on to the indurated and irregular cicatricial tongue (*vide* Plate 195, fig. D).

As globular swellings.

In some instances the gummous material is either poured out soft or as a solid, which soon breaks down; under both circumstances appearing as a cystic enlargement in the body of the tongue. I have seen, in some cases, four or five of these cystic swellings in a tongue thus affected, and on opening the same have given exit to a thin fluid. The enlargements appear as single or multiple globular tumours in the body of the tongue.

As mucous patches.

When the disease occurs in the shape of *mucous patches*, it is usually associated with other symptoms; the patches are commonly multiple, and are for the most part situated on the upper surface and edges of the organ. They appear either as moist papules with whitish tops, as red, circular, or irregular excoriations, or as granulating surfaces projecting as white, moist raised growths. The mucous patches in the tongue are precisely like those seen in other mucous membranes, and, indeed, are identical with them.

They may occur with the first onset of constitutional symptoms, or not show themselves till a remoter period of syphilitic inoculation. They are very prone to reappear after their supposed cure.

When syphilis attacks the tongue as a local infiltration of gummous deposit, it does so usually long after the primary inoculation, even after twenty or more years.

It may do so as a single, or more commonly as a multiple, more or less rounded infiltration of the submucous or muscular tissue of the tongue, and the swellings may be pea-like or nut-like; at first these swellings will be hard, but as time progresses changes will occur in them. If allowed to run their course they will enlarge and break down, open and discharge; if treated they may soften and be reabsorbed, or wither and dry up, the latter change being very rare.

As deep ulcers.

When this affection is allowed to run its natural course, the swelling will enlarge and subsequently break up; the hard lump will increase and become softer, the soft parts covering it in will redden, inflame, and open either by an ulcerating or sloughing process; and when the contents of the lump have been discharged, either a ragged cavity will be left to granulate or a fissure to heal. The edges of the cavity or fissure are under all circumstances perpendicular and sharply cut, as shown in fig. E, Plate 195.

The cavity, when the parts have opened by a sloughing process, will be more or less ragged according to the amount of destruction of the tissue of the tongue, and it will present a surface which will vary according to the stage of the disease. When looked at during the period of sloughing, the dead tissue infiltrated with the *yellow* infiltrating material, of a wet, wash-leather appearance, will readily be recognised; and when seen at a later period, the irregularly excavated cavity, with sharply cut perpendicular uninfiltrated edges, will generally enable the surgeon to diagnose the disease from the one for which it is often mistaken, a sloughing cancer. The common want of enlargement of the lymphatic glands in this specific affection of the tongue is another help to diagnosis. At a later period, when repair has taken or

is taking place, an irregular, yellow-white cicatrix (leucoma) will be seen, *vide* fig. D, Plate 195, and the tongue eventually will show marked evidence of the destructive processes of which it has been the seat. Wasting of some parts of the tongue, scarring of others, mixed up with irregular cicatricial tissue, being the chief characteristics of a repaired syphilitic tongue.

In tongues that are brought rapidly under the influence of appropriate treatment, the changes that have now been described may be considerably modified. Thus the nodular infiltrated mass may soften, and the deposited material may be reabsorbed. The tongue itself will become supple and more natural, and a cure may take place —a cure, however, which, in some cases, is attended with a wasting of the portion of tongue that was infiltrated, or a loss of the natural papillary tissue upon the surface of the tongue which corresponds to the seat of infiltration.

What, however, is of far greater importance to remember is, that a tongue which has been the seat of syphilitic disease frequently becomes the subject of a cancer. The altered nutrition brought about by the irritation of the one affection, encourages the development of epithelial disease. A relapse of this affection after an apparent cure is also very common.

Treatment.

Treatment.—When the diagnosis of this many-faced disease has been made, the line of treatment to be adopted is not difficult to lay down, for there can be but little doubt that some mercurial medicine is the most certain drug to employ, where there are no indications against its use; and, on this being rejected or found wanting, the iodides of potassium, sodium, or ammonium, in gradually increasing doses, are to be used.

The disease must be dealt with as a general and not as a local one; and the local affection is to be regarded as one of the manifestations of a constitutional disorder which may appear in other seats, though as yet it may not have done so.

By mercury.

When mercury is prescribed, the perchloride in doses of one-sixteenth of a grain in bark may be given; or what I like as well—a pill of half a grain of the green iodide of mercury twice a day. In both cases the dose should be gradually raised to double the strength indicated.

By iodides.

When mercury is contraindicated on account of the patient's cachectic or feeble condition, the iodides may be commenced at 5-grain doses and steadily increased week by week by a grain up to 12, 15, or 20-grain doses three times a day. The iodide of sodium may be at times substituted for the iodide of potassium. Tonics are often required at the same time, with good simple food, fresh air, and regular habits. Stimulants should be given very sparingly, and all smoking should be strictly prohibited. As a local application the lotion of boracic acid or chlorate of potash gr. x to the ℥j of water is of value, and the recommendation of Mr. H. Morris to rub a piece of blue-pill mass once or twice daily over the surface of the sore is worthy of adoption. When the disease has apparently disappeared, the treatment must be continued for some, possibly for six months, this practice being necessary to guard against a relapse. The routine practice of applying the nitrate of silver to these sores cannot be too strongly condemned.

In the "lumpy tongue," in the stage in which the lumps are soften-

ing, I have found the simple operation of puncturing the tumours to be of great use—by procuring the escape of the contents of the lumps, which are often serous—thereby relieving tension and certainly expediting the cure.

Syphilis and cancer.

In cases of long standing disease, the fear of the tongue becoming the seat of cancer should ever be before the Surgeon, and the fact of a tongue having been the seat of an old syphilitic affection should tend rather to support than to weaken the view of a doubtful excavated ulcer of the tongue being of a cancerous nature. At any rate, where the doubt exists let it rather encourage surgical interference than prolonged medicinal treatment; for in a clinical point of view a chronically affected syphilitic tongue had better be occasionally removed than a cancerous one left to run its course.

Cancer of the Tongue.

Cancer.

This distressing disease is met with in about five out of every hundred cases of cancer, and is an affection of adult life; an analysis of 102 consecutive patients admitted into Guy's Hospital, and seen by me, shows that 80 out of every 100 affected by it were over the age of forty-five; 12 were under forty years of age; 27 between forty-one and fifty; 31 between fifty-one and sixty; 25 between sixty-one and seventy; and 7 over seventy years of age. This disease may, however, occur as early as twenty-seven.

Statistics of.

It is more common in male than female subjects, in proportion of 80 to 22.

The disease is *always* of the epithelial form, and is essentially an isolated infiltration of the papillary or mucous surface. It usually shows itself as a blister, crack, ulcer, wart, or superficial tumour upon the tip or side of the tongue, and is in the majority of cases single. It then breaks down and discharges (*vide* Plate 196, fig. F), leaving a more or less ragged, irregular, excavated sore, with raised, indurated, infiltrated, and mostly everted edges (*vide* Plate 196, fig. G).

The disease is at first always local, but later on, when allowed to take its course, it will spread and involve the floor of the mouth, fauces, gums, or jaw-bone. It will, moreover, always, sooner or later, implicate the lymphatic glands.

At times the diseased parts slough more or less extensively (*vide* Plate 196, fig. F), and in a case which was under my care in 1866, the whole organ sloughed off before the man died. It affects one side of the tongue as much as the other, and is at times central. But wherever it may commence, it will soon involve neighbouring parts.

It originates at times without any definite cause, but in the majority of cases it is excited by some local irritation such as that caused by a broken or rough tooth, a hot pipe, an antecedent syphilitic affection (Plate 196, fig. F), or the disease which is now known as ichthyosis (Plate 196, figs. G, H, I).

It may originate also in a scar on the tongue, as it is well known to do in scars of other parts. In 1880 I saw a case in which the disease had attacked the tongue of a man, æt. 57, who had bitten off its tip five months before in an epileptic fit, and a second in 1875, in a man, æt. 70, who had injured his tongue by a fall two years before.

Diagnosis.

Diagnosis.—Any localised *infiltration* of the papillary or mucous covering of the tongue, however limited it may be—in a patient over forty—should be suspected to have an epithelial origin; and should this

be found in a part of the tongue in which no local source of irritation can be discovered, the suspicion becomes a certainty.

Infiltration with ulceration.

Should the infiltration coexist with ulceration and a local source of irritation be made out—such as a broken or rough tooth—the probabilities of its being due to this local irritation may be regarded as great; but should the disease fail to undergo a rapid cure upon the removal of its supposed cause, the conclusion should be drawn that the disease is cancerous.

From syphilis.

When a tongue has been the seat of a chronic syphilitic affection, and more particularly is one in which a series of relapses has taken place, with uncertain intervals of apparent convalescence; and when it presents an indurated, infiltrated tissue, with a more or less excavated, ulcerating, or sloughing cavity, with irregular, everted, and raised, rather than sharply cut and defined edges, the diagnosis of the disease being cancerous is highly probable, and when with these symptoms the lymphatic glands beneath the jaw are found enlarged, the diagnosis becomes a certainty.

When again this local infiltration with or without ulceration is found in a tongue which has been the seat of an old syphilitic leucoma, or the subject of that peculiar disease of the papillary mucous membrane known as ichthyosis (*vide* Plate 196, figs. G, H, I), there should be no question as to its true nature, for it should be accepted as a fact that chronic syphilitic, as well as chronic ichthyotic disease, renders the tongue peculiarly liable to undergo changes in its epithelial elements which most commonly reveal themselves as epithelial cancer.

Trans. of Med. Soc.,' 1882.

Mr. Morris has recorded, in an able paper on this subject, the fact that out of fifty-five cases of cancer of the tongue, in thirteen, or about one-fourth, the organ had been the seat of ichthyosis. I am quite prepared to support him in this average.

Treatment.

Treatment.—There is but one form of treatment of cancer of the tongue that can be recommended with any confidence, and that is the removal of the disease by some surgical operation. And there is but one period at which this operation is likely to prove successful as a cure, and that is in the early stage of the disease, when the cancer is local and when it involves no other tissues than those in which it was primarily placed.

Removal.

When the disease has extended beyond these limits and through the lymphatic channels has implicated the lymphatic glands, the prospects of a cure are not favorable even if they can be said to exist, since, whilst the glands that lie along the ramus of the jaw may be readily removed, those that lie buried behind the angle are beyond the Surgeon's reach, and to remove some of, and not all, the infected glands is a futile proceeding.

Operations.

When a local cancerous disease is removed it should be a rule of practice that all enlarged lymphatic glands should be removed likewise; and this rule is as applicable to the tongue as it is to other parts.

As to the best means for the removal of a tongue, wholly or in part, Surgeons are found widely to differ—one advocating strongly the removal by the knife or scissors, whilst others as strongly urge the use of the écraseur, employed either as a crushing or as a burning force. The chain, or wire instrument, is used in the crushing, and the platinum wire heated by means of a galvanic battery as the cautery écraseur. For many years I employed the galvanic écraseur and found no fault with

it; of late I have again resorted to the chain or wire instrument, but have had no reason to be better satisfied with my results. I altered my practice in deference to a strong opinion that has been given by some Surgeons as to the dangers of the galvanic and greater safety of the simple écraseur, but this opinion does not find support from my facts.

Statistics of operations.

With the view of testing this point I have extracted from our Guy's Hospital Records forty-six consecutive cases of operation, and find that of thirty-six operated on by the galvanic écraseur four died from the operation, or 11·1 per cent., and four from other causes. Of seven cases operated on by the chain or wire écraseur, one died from the operation and one from the disease. Of one removed by excision and two by ligature, none died. Of the whole number of forty-six cases five died from the operation, or 10·8 per cent., and five from other causes.

Of the five fatal cases from the operation, two sank on the 8th day, one from pleurisy and the other from broncho-pneumonia. One on the 20th day from broncho-pneumonia and one on the 20th from exhaustion and repeated small bleedings, The single fatal case after the use of the chain écraseur was on the 12th day from broncho-pneumonia.

One of the five cases that died after the operation, though not from it, sank on the 36th day from recurrent disease and gangrene of the lung. Three on the 53rd, 48th, and 32nd days respectively from recurrent disease and exhaustion, and one on the 38th day from recurrent disease and pyæmia.

It will be thus seen that *three* out of the eight cases that died after the use of the galvanic écraseur, and *one* out of two cases that had been operated on with the chain or wire instrument, or *four* out of the whole number of forty-six cases of operation, or 8·7 per cent., died from lung complication; and the records of the pathologist tell us that such a complication is by no means infrequent when no operation has been performed. At any rate, evidence is wanting to show that this lung complication is more common after operation than it is without, or when it follows operation that the operation has anything to do with the lung disease.

It is true that the inhalation of fœtid or septic elements, when the tongue is sloughing either by natural processes or as a consequence of operation, must of necessity be prone to bring out this lung trouble; but this fact, instead of being adduced as an argument against operative interference, may fairly be used as one in its favour, since to get rid of the sloughing and fœtid organ is one of the Surgeon's aims in an operation, and to do so in the quickest, safest, and simplest way is his object.

Galvanic écraseur.

When the galvanic écraseur is used and the cauterised tissue is rendered aseptic by means of a plug of iodoform gauze well pressed upon the surface after operation; or when the charred or bruised surface, after the use of the galvanic or wire écraseur, is kept sweet by the repeated application of the colloid styptic, which, Mr. Morris tells us, "tans the surface of the wound, causes little or no slough, and corrects the fœtor of discharge," there is less fear of any evil result from septic causes than there was before the disease was removed.

There is consequently no argument against the use of the écraseur that has any weight.

Whilst, therefore, for the removal of a tongue, wholly or in part, I have a preference for the écraseur, and for the galvanic over the wire or

chain instrument, I am ready to admit the value of excision by means of scissors or the knife, or of any of the different modifications of these operations which the ingenuity of different Surgeons has suggested.

For I believe that in individual cases one form of operation may be more applicable than another, and that in the hands of any Surgeon the mode of operating he excels in is the best for his patient.

I may say, however, that I have not yet seen a case in which the division of the lower jaw as taught by Syme has been required.

Most tongues can be removed through the mouth, however extensive the disease may be, if the organ be well drawn forward by means of a thick ligature introduced through the body of the tongue, and if it is freed from its attachment to the lower jaw and fauces by the division of its mucous membrane attachments. There is no objection to the removal of a whole tongue in halves, though there is no advantage in so doing. If more room should be required, this is best obtained by means of an incision across the cheek from the angle of the mouth, the écraseur being then worked sideways.

Bleeding.

Bleeding during an operation need cause no alarm, if the operation be performed leisurely, since it can be speedily controlled by the torsion of the divided artery, if the tongue be well drawn forward; in many cases the simple drawing forward of the tongue suffices to bring about this result; the artery receding into the muscular tissue.

Ligature of lingual arteries.

I can see no advantage in adopting the practice of Demarquay, of ligating before the operation the lingual arteries, although when severe bleeding takes place after the operation the practice may be good. The operation, however, may be performed, in cases in which the removal of the disease is inexpedient or impracticable, with the view of bringing about wasting of the diseased organ.

Division of gustatory nerve.

The division of the lingual gustatory nerve on the inner side of the lower wisdom teeth, as practised by Hilton 1850 and Moore 1861, for the purpose of relieving pain, is also a practice to be strongly recommended.

It must likewise be recorded as one of the advantages of excision of the tongue, that should a return of the disease take place it is more likely to do so in the lymphatic glands of the neck than anywhere else. Under these circumstances the patient is relieved of his distressing local affection and sinks slowly and comparatively painlessly. I have often heard with pleasure, even under these miserable conditions, expressions of gratitude from patients who have gone through the operation; gratitude for the sufferings they have been released from and spared.

Effects of operation on life.

I may also add that it seems probable that life is materially increased by the operation. In some cases I have to record, the increase was great, and even when a return takes place there is a degree of increase. Mr. Morris states that out of fifteen cases operated upon, the average duration of life was sixteen months, whereas in those in which no operation was performed it was but ten and a half, only two cases having been known to have lived eighteen months.

In the cases I now record a decided increase to life must be admitted, and particularly if we take the average of life with this disease when left alone as ten and a half months.

Cases after operation.

In 1866 I removed the anterior half of the tongue from W. P—, æt. 60. The patient remained well so far as the tongue was concerned for fifteen years when disease reappeared in the scar. The patient

at this time was suffering from hemiplegia and senile decay, of which he died. Results of Operation.

In 1872 I removed from Mr. S—, æt. 45, half his tongue for a local cancer. He reported himself to me as well *ten years* later, 1882.

In 1871 I removed a local cancer from the tongue of Mr. R. W—. No return ever took place though the patient lived *five years* and died from anæmic gangrene of the foot.

In 1870 I operated on H. S—, æt. 70, and removed a cancer with the anterior two-thirds of the tongue. *Three and a half years* later he reported himself as well.

In 1869 I removed a portion of the tongue from H. J—, æt. 42. He lived *two years* and had no return and died from lung disease.

I can trace two cases now alive and well who have been operated on for *two years*, and two who are well one year after operation, and have records of three who survived the operation for 18, 18, and 11 months respectively.

Altogether out of a somewhat limited personal experience the above record of facts must be regarded as encouraging, clearly showing the possible benefit of the operation, and the probability of a cure being obtained in a larger number of cases, if the operation were undertaken as soon as the diagnosis of the local disease has been made.

Tubercular Ulceration of the Tongue.

It is right that this disease should have a special notice, since it is neither common nor generally recognised. It has, however, features of its own which claim attention. I have seen several examples of it but have only records of two. Tubercular ulceration.

It occurs in feeble subjects and begins as a papule which soon ulcerates and in spite of treatment passes into a sore or fissure. A second and third sore soon follow the first and run the same course, the same in its obstinacy and the same in its tendency to form a fissure or excavation. When it presents the latter appearance, the surface of the sore will be that of an old indolent ulcer on other parts; its base will be more or less infiltrated, but never hard like that of cancer; and its edges though infiltrated will not present the sharply cut aspect of the syphilitic fissure, nor the elevated everted irregular border of the cancerous; the secretion from the sore is often cheesy. In fact the sore is neither like the syphilitic nor the cancerous, and yet for want of its recognition it is usually taken for one or the other. Symptoms.

In one case the ulcer appeared as a fissure with an indurated base and infiltrated edge. In another the ulcers were irregular, their edges but little thickened, or hardened, and their floors were formed by a soft-looking, cheesy material. Add to this, that the cuticular covering of the tongue was unnaturally glazed and red or livid, with numerous small superficial erosions, of similar type to the larger ones, affecting a large part of the surface, and the disease makes a picture which, once seen, is neither likely to be forgotten nor mistaken.

"Sections of the tongue showed that the cheesy material had invaded the muscular structures to some depth, and of the microscopical examination, it is only necessary to say that it revealed a thick infiltration of the tissue by lymphoid cells, which were in many parts granular from degenerative changes." 'Guy's Hosp. Reports,' 1883, p. 134.

Altogether the clinical and pathological features of this disease

Collis's mode. by pins, and remove it by the écraseur—wire rope being used when the galvanic cautery écraseur cannot be obtained. To isolate the disease, I have found the curved needle, as seen in Fig. 197, introduced through the base of the tongue, behind the disease, to be very valuable.

Fissures of the Palate.

On fissures of the palate. The hard and the soft palates are liable to fissure, partial or complete, or both palates may be involved. It may be that the fissure appears as a mere notch in the alveolar process, in the line of junction of the superior maxillæ with the intermaxillary bone as is seen so commonly in harelip, or, it may pass backwards towards the velum. On the other hand, the soft palate may show only a bifid uvula or a complete fissure. The fissures in the hard and soft palates are almost always in the middle line, although where they involve the alveoli, they diverge as they involve one or both sides of the intermaxillary bone; in fact, they usually follow the line of suture, as seen in Fig. 166. Fissure of the soft palate alone is more common than that of the hard. Yet it is very rare for the intermaxillary bone to be so displaced, as seen in Fig. 171, without fissure of the palate. Mr. Mayland has recorded an exceptional example of this deformity ('Lancet,' November 24th, 1883), and in a case I recently treated the girl had a transverse band, half an inch wide, joining the two sides of an otherwise complete fissure at the level of the palate bone. These malformations, when severe, interfere much with speech, and give rise to much difficulty in sucking and deglutition, the food passing through the nose. To relieve this, Mr. Oakley Coles has ingeniously adapted a flap of india rubber to the upper surface of the nipple of an ordinary feeding-bottle, which, when the infant sucks, rises up and fills in the gap. Where this cannot be obtained, the child should be fed from a bottle with a piece of elastic tubing on its nozzle to fall over the roof of the tongue. Partial fissures are of little importance.

Treatment of fissure of palate. TREATMENT.—When fissure of the palate co-exists with harelip, the lip may be operated upon as usual irrespective of the fissure.

Operations when to be performed. Operations for the repair of the fissure have, till recently, been put off till the child was of an age to give assistance to the operator. Billroth was the first to operate in infancy, and did so with success on a child, twenty-eight weeks old, in three operations. In 1868, Mr. Thomas Smith introduced to the profession a gag (Fig. 199) that holds the jaws open and depresses the tongue, enabling the Surgeon (with the patient under the influence of chloroform) to undertake the operation at a very early period; indeed, Mr. Smith has quoted cases where he operated at three years of age ('Med. Chir. Trans.,' 1868; 'St. Barth. Hosp. Rep.,' 1871). It may generally be undertaken at the age of five, in a healthy child, and I have performed it successfully at four years of age.

History of operation. Roux was the first who practised the operation with advantage, having in 1819 successfully treated a medical student for cleft palate. Dr. Mason Warren, of Boston, did also much towards encouraging the

Fergusson's method. practice; but, in this country, there is no doubt that to Sir W. Fergusson is due the credit of having demonstrated the value of the operation and of suggesting improvements therein. In his chief paper, published in 1845 ('Med.-Chir. Trans.'), he showed "how the *levator palati* on each side had such free and uncontrolled action that, whenever excited,

it drew the margin of the cleft outwards and upwards, and so tugged upon the stitches put in by the surgeon that ulceration in their sites

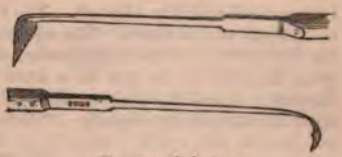
Fig. 199.



T. Smith's gag.

was a most probable result." He therefore suggested the division of this muscle in all cases, and that of the palato-pharyngeus in some. He did this by means of a curved knife (Fig. 199A) passed through the fissure, so that its point can be laid on the tissues immediately above the soft velum, midway between its attachment to the bones and the posterior margin, and about half way between the velum and the lower end of the Eustachian tube. The point is then thrust deep, and carried half an inch or more backwards and forwards so as to cut the levator palati. By these means, the palate is paralysed for a time, and so repair goes on with greater certainty.

Fig. 199A.



Fergusson's knives.

For fissures of the hard palate much has been done in more recent times. Dr. Mason Warren, in 1843, described the process of separating the hard from the soft palate with the view of its closure, though it has been left to Langenbeck, Billroth, Pollock, Avery, Lawson Tait, Annandale, T. Smith, and others, to perfect the process. Mode of performing the operation.

The operation.—Chloroform is not necessary in a patient old enough to understand the necessity of being still and assisting the surgeon. In young children, with Smith's gag, it is an advantage. Chloroform.

The recumbent position, with the head sufficiently thrown back, is probably the best, although some surgeons make the patient sit. The operator should stand on the patient's right side, or, in front. The steps of the operation have been hitherto as follows:—Pare the edges of the fissure; pass the sutures; paralyse the muscles; and fix the stitches. To pare the edges, a blunt-pointed bistoury is generally used, and a thin border of mucous membrane cut off from below upwards, the bifid uvula being held by a tenaculum-pointed forceps (Fig. 200). The incision also should be made as clean as possible. When it is made from above downwards, a sharp-pointed bistoury is needed. To Position of patient. Of surgeon.

pass the sutures, a corkscrew needle may be employed, or a curved needle flattened laterally (Fig. 201), with a slit in it for an eye, or an eye in the end. The lowest suture should be inserted first and both ends held — this practice facilitating the introduction of the others. The best material for sutures is fine gut; Mr. Smith uses horsehair for the lower stitches. I have rarely used anything but gut for all plastic operations since the year 1860, taking the precaution to select and to soak it in water for some minutes before using it.

Fig. 200.

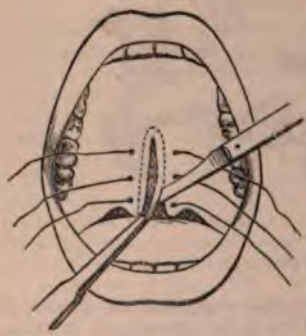


Figure showing the paring of the edges of fissure, after the introduction of the sutures.

If Sir W. Fergusson's plan of paralysing the muscles be employed, it should be, as he advises, as a preliminary step to the operation. If Sedillot's or Pollock's plan be followed (Fig. 202 *b*), it may now be done by inserting a knife through the velum about a third of an inch from the highest suture, and cutting along the posterior edge of the hard palate towards the free margin, but not through it. This is the course

Mode of applying the sutures.

I have until recently adopted. The two pillars of the fauces may then be snipped with scissors. The sutures have then to be fastened, and the best plan is, to run a perforated shot over the gut and clamp them, tying the ends of the gut in a knot to prevent the possibility of their slipping. I usually begin at the highest. Care should be taken not to draw the stitches too tightly. "Sutures," says Pollock, "should hold

Fig. 201.



Needles employed in fissured palate.

not draw parts together, if union is to follow." The parts should be sponged as little as possible, and the less manipulation there is the

better; any irritation causing so free a secretion of mucus as to interfere greatly with the surgeon's proceedings. Rapidity in operating is consequently an advantage. When the parts require to be cleansed in the adult, iced water may be used as a gargle; and with a child under chloroform, the stitches may at times be inserted and the edges pared before any cleansing is required. In deep mouths where difficulty is experienced in passing the sutures, a clever manœuvre suggested by Avery may be called for, and is illustrated in Fig. 202 B; one end of

FIG. 202A.



Fig. illustrating line of incision, employed to relieve tension of the palate after the edges have been adjusted.

FIG. 202B.



A. Avery's plan of passing sutures.
B. Fergusson's plan of fastening sutures.

the gut C is pulled through the soft palate and the end passed through a loop of silk (A) inserted on the right side; on pulling the loop the end C will be drawn through the right side. When silk is used, the double reef knot as shown at the lower part of Fig. 202B, and generally adopted by Fergusson, is very serviceable.

New methods of proceeding.

In some cases I have been able to simplify the operation by altering its steps; that is to say, I have first introduced sutures through the soft palate, taking care to do so a quarter of an inch from the free border of the fissure, and secondly pared the edges, employing for this purpose a pair of scissors with short blades placed at right angles to their shanks or a knife. By this practice, the introduction of the sutures is an easy proceeding, and, consequently, very rapidly effected, and the bringing together of the pared edges can be readily accomplished.

To relieve tension of the parts I now divide the soft palate laterally, as shown in Fig. 202A, the side cuts (A) subsequently gaping, so as to appear as arches (B); in this way the muscles of the palate are completely paralysed and the soft palate itself appears as one large uvula.

I have performed the operation already described on many occasions, and with success. In none was there even a pin-hole left. Its simplicity is very striking. It cannot, however, be applied in all cases.

When stitches to be removed.

The stitches may be left in for five, ten, or even fourteen days, the amount of *irritation being the* guide to their removal. When union

has taken place, the sutures only act as irritants, and in this as in all plastic operations, they should be removed as early as possible with safety. During the process of repair the patient may freely take soft food, swallowing by no means tending to separate, but, on the contrary, to close the wound. Stimulants may be given when desirable.

Patient to be in good health.

The operation should only be undertaken in healthy patients, in the feeble it is almost sure to fail. After the operation the patient's friends should not be led to expect that an immediate change for the better will be traced in the voice, as such is never the case, indeed a long interval of time as well as a process of education is necessary to acquire this result, although in many instances, the improvement is very great. How far an operation in infancy tends in this direction has not yet been proved, sufficient experience in these early operations, as yet, not having been acquired.

Where a small opening is left.

If a small orifice near the hard palate be left after the operation, no necessity exists to interfere again, because it is a clinical fact that they have a strong tendency to contract, and, the younger the patient, the greater the probability of complete closure.

Tait's modification.

Mr. Tait believes, and I think rightly, that if the muco-periosteum of the hard palate be elevated with a raspatory from the semilune of the palate bone, the tendinous attachment of the tensor palati will be raised with it, and thus paralysed, thereby doing away with the necessity of any such division of muscles as practised by Pollock or Fergusson, and diminishing the risk of the pin-hole orifice at the junction of the hard and soft palates. He advocates, moreover, two or more operations, viz. the hard palate to be first closed and the soft after some months' interval.

Fissures of the Hard Palate.

Fissures of hard palate.

These are to be treated on similar principles to those of the soft, the great point of difference consisting in the separation of the soft parts with the periosteum from the bone. For this purpose Langenbeck's instrument is the best—a kind of small hoe; with this, after making an incision down to the bone along the edge of the gum, he scrapes all the soft parts from the bone down to the free border of the fissure, the covering of the palate then hanging as a free curtain. Care is required in this proceeding not to tear or injure the soft parts, and more particularly the anterior and posterior portions where the vessels enter. The other steps of the operation are such as have been already described.

Operation.

Fergusson's new operation.

Since November 22, 1873, however, Sir W. Fergusson has adopted with great success a method of dealing with fissures of the hard palate, which was originally proposed by Dieffenbach in his 'Operative Surgery,' 1845. There is a want of evidence that the operation was ever previously performed, and Sir W. Fergusson was not aware even of the suggestion when he published his paper ('Brit. Med. Journ.,' April, 1874). The operation, as seen in Figs. 203 and 204, is as follows:

Holes are first drilled with a curved brad-awl through the margins of the hard palate (Fig. 203, c) for the passage of the threads, while the palate itself is then cut through with a chisel in a line parallel to and about half an inch from the edge of the cleft (Fig. 203, B), such a step being much facilitated by acting upon Mr. Mason's suggestion of previously drilling the bone with the curved brad-awl (Fig. 203, A). This loosening of the margins of the hard palate allows the borders of the

cleft to be brought together along its whole length, after the margins have been pared and the stitches twisted (Fig. 204). When any difficulty is experienced in approximating the loosened portions of the hard palate the bones may be separated and prised down by means of the chisel, and the lateral openings plugged with lint. Indeed, if the

FIG. 203.

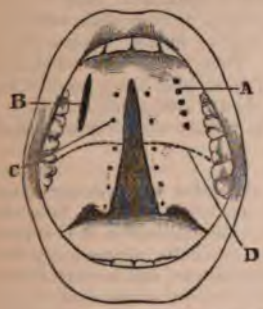


FIG. 204.



A. Preliminary punctures with awl to give line for chisel.
B. Incision through bone completed by chisel.
C. Holes bored through hard and soft palate for sutures.
D. Junction of hard and soft palate.
E. Lateral openings subsequently filled up by granulation.
These drawings were kindly made for me by Mr. W. Rose.

bones are well loosened and the lateral openings well plugged, no sutures are required through the hard palate, the parts falling well together. The operation is very valuable, and in my hands has been successful.

Use of metallic plate.

When operative relief cannot be given in these cases or has failed, the patient must be handed over to an experienced dentist, for with a good obturator of gold or other material, great comfort can be given, and even a velum may be supplied of india rubber. On these points an article in 'Holmes's Surgery,' by my friend Mr. James Salter, may be consulted with advantage. Operative relief, however, is always superior to instrumental, as in the latter the patient is entirely dependent upon the mechanist.

Wounds of the palate.

Wounds of the palate are met with in practice from patients falling with pointed instruments in their mouths, such as pipes, sticks, spoons, &c. Small wounds need no attention, and generally do well; lacerated wounds dividing the velum should be brought together by sutures; but where they have been left and a separation ensues, the edges may be subsequently pared and brought together as in fissured palate.

Perforation of hard palate.

Perforations of the hard palate are generally due to the exfoliation of bone, and no plastic operation is of use. The proper treatment of such cases is to close the aperture by an accurately fitting plate of metal or vulcanite attached to the teeth, and arching immediately below the palate, but making no pressure upon the edges of the hole itself, as the effect of a plug is to enlarge the aperture by absorption.

Ulceration of palate.

Ulcerations of the Hard and Soft Palates.

These are very common as a result of syphilis, and appear as *superficial ulcerations* about the pillars of the fauces and margins of the velum. They are often preceded by an erythematous redness and take on a sloughing action in cachectic subjects. They appear, too, also as *mucous patches* at any stage of syphilis, congenital or acquired, involving at the same time the tonsils, tongue, &c. They appear as slightly elevated spots covered with ashy or yellowish membranes, beneath which some slight ulceration may be found. Frequently they are associated with other symptoms. They are to be treated as part of a constitutional disease, such local treatment being applied as the aspect of the surface may demand. Local astringents, as alum and borax, are, as a rule, of value, and also nitrate of silver or iodoform when local stimulants are needed.

Strumous ulceration.

Strumous Ulceration of the Palate.

This is a distressing affection, the ulcerative action being often so rapid as to destroy within a few days the whole fauces. It is chiefly met with in the young and feeble. In other instances it is slower in its action, though equally destructive, gradually eating away all the soft tissues, even to the hard palate and pharynx, and is often mistaken for syphilitic disease, or *vice versâ*. The history of the case alone can determine the point. Tonics and local stimulants are, as a rule, the only requisite treatment; good food, of a liquid nutritious kind, being supplied in abundance. When gargles are difficult to use, carbolic acid lotion, sulphurous acid, Condy's fluid, or iodine lotion (a drachm of the tincture to a pint of water), may be scattered over the parts with the spray producer. In certain cases a powerful local caustic, such as nitric acid, applied with a glass brush, tends to arrest the action. As a result of ulceration of the soft palate, it sometimes happens that the palate becomes completely adherent to the posterior part of the pharynx. In one case under my observation there was only an opening the size of a crow-quill between the pharynx and the nose, which I subsequently enlarged and kept dilated by means of tents with great advantage. In another a central fissure existed, leading down to the œsophagus and upwards to the nose. In this case the patient experienced great difficulty in deglutition. He had to eat with the greatest caution, otherwise the food would pass into the larynx. Cases are on record in which it has been found necessary to enlarge this pharyngeal opening, and even to open the trachea to maintain life. Under such circumstances it is probably a wise maxim always to open the windpipe before any operative interference is undertaken in order to enlarge the pharyngeal opening.

Treatment of ulcers of palate.

Results of ulceration.

Adhesion of palate to pharynx.

Tumours of palate.

Tumours of the palate, cystic or solid, are occasionally met with. I have treated several cases of warty growths, simple and malignant, and in 'Guy's Reports,' 1869, I have recorded an interesting case of myxoma which covered the whole of the hard palate, and was cured by removal.

In August, 1872, I also removed from the soft palate of a man æt. 38, a globular fibrous tumour of six years' growth, the size of an unshelled walnut, which had been for six weeks seriously interfering with deglutition and respiration. I enucleated the growth after making a free incision into its capsule, having previously been obliged to perform tracheotomy to prevent suffocation. In this case I employed Dr. Trendelenburg's tracheal tampon (Fig. 205), and found it of great

value. It effectually prevented the entry of blood into the air-passages, allowed the patient to be kept under the influence of chloroform, and enabled me to complete the operation with facility and safety. (*Vide* 'Med. Times and Gaz.,' May, 1872.) Where this instrument is not at hand, the fauces may be well plugged with sponge after simple tracheotomy.

The majority of cases of tumours that involve the palate, spread from the gums or upper jaw.

Fig. 205.



Section of trachea, with Dr. Trendelenburg's tracheal tampon.

Elongation of the uvula from inflammatory œdema is sometimes a very acute affection. It comes on rapidly at times, and gives rise to suffocative symptoms. I have seen a case in which the uvula became as thick as a finger and rested on the tongue with its tip forwards, and of this, there is a drawing at Guy's. An incision into it, or several punctures, may give relief; but, as a rule, it is better to cut off the lower half of the organ. Elongation from congenital or other causes is far more common, and is generally to be recognised by the peculiar hacking cough and husky voice to which it gives rise, the end of the uvula acting as a constant irritant to the epiglottis or even glottis. There is reason, indeed, to believe that not a few of the cases of supposed laryngeal irritation are due to this cause. The removal of the lower half of the organ by means of a long pair of forceps or scissors, rapidly gets rid of all the symptoms.

Elongated uvula.

A polypus composed of simple mucous membrane may grow from the uvula. I have removed one from the tip, and another from the base. They give rise to symptoms identical with those of elongation. I had also a case under observation in which the polypus had so long a peduncle as to fall at times into the orifice of the larynx, and excite a violent spasmodic cough, but the man refused to have it removed.

Polypus of uvula.

Tonsillitis.

Tonsillitis.

As an acute affection this is known as *quinsy*, and is characterised by the rapid swelling of the part, acute pain, foul tongue, and fever. Within three days, or longer, suppuration may occur, and, when suffocative symptoms make their appearance, the surgeon's interference may be demanded. At times, life may be sacrificed by the want of surgical attention. Some years ago a case came before my notice, where a child, two years of age, was suffocated from the bursting of a tonsillitic abscess.

Great redness and rapid swelling of the organs are the chief local symptoms.

Treatment of tonsillitis.

Treatment.—Fomentations externally, the inhalation of hot steam, and the administration of saline purgatives, are essential points of practice. As to drugs, none seem to have so powerful an influence over the disease as guaiacum, an ounce of the mixture with some compound spirits

of ammonia being the best form, and when this is employed early, suppuration rarely appears. When an abscess has formed, the sooner it is opened the better. The best mode of doing this is to cover a straight bistoury to within half an inch of its point with lint, and having depressed the tongue with the finger, to introduce it into the swollen tissue, making a free incision; care being taken not to direct the point of the knife outwards, but directly backwards. Should pus appear behind the pharynx, it must be let out. Tonics, such as quinine or iron, should then be given, with good food; a speedy convalescence as a rule ensues.

Tonsillitis maligna.

Tonsillitis Maligna.

This is a form of inflammation of the tonsils met with in feeble subjects which results in ulceration, and is often most intractable. It begins as other forms of inflammation, and runs its course rapidly, the ulcerating process being generally associated with sloughing. The parts about the tonsils, even the root of the tongue, often become involved. The disease is at times associated with scarlet fever or syphilis.

TREATMENT.—This affection being always found in feeble or cachectic subjects, requires tonic treatment both with food and medicine. Beef broths and milk with stimulants are always required; nutrient enemata should be used when enough nourishment cannot be swallowed. Quinine and iron as medicine are also called for, with small doses of laudanum to soothe pain. Locally, sulphurous acid, employed every hour or less as a spray is very beneficial, or the local application of the mixture of iron and glycerine.

Chronic enlargement of tonsils.

Chronic Enlargement of the Tonsils.

This is frequently met with in feeble children as well as in adults living in marshy and damp localities. It is often a sequel of the acute inflammation, but more often it appears without any such cause. There is reason, too, to believe that some of the cases of so-called chronic enlargement of the tonsils are due to new adenoid tonsillitic growths. On two occasions when removing these enlarged organs, I have turned out distinct tumours the size of nuts embedded in and surrounded by tonsillitic tissue. The tumours were distinctly glandular, and, under the microscope, could not be distinguished from tonsil tissue. In both cases the enlargement was unilateral. Bilateral increase is probably always due to hypertrophy or chronic inflammatory enlargement.

Symptoms caused by enlarged tonsils.

Enlarged tonsils give rise to a peculiar nasal twang in speaking and to a most distressing snoring, the patient as a rule having a half-opened mouth night and day. They are commonly associated with irritable mucous membranes generally. I have seen them so troublesome in a child three and a half years old as to prevent the deglutition of solid food, the patient having lived for six months on liquid nourishment.

Treatment medical.

Tonic treatment is essential in all these cases; so is a *simple* nutritious diet. A mixture of bark and soda at first is the best to soothe and give tone to the digestive apparatus, cod-liver oil, quinine and iron, being subsequently prescribed. When the organs are congested from inflammation, a mixture of glycerine and tincture of the perchloride of iron, in equal parts, should be used. It is wise also to give the patient some solid iodine in a perforated box to stand on a shelf in the day as well as in the sleeping room; the gradual evaporation of the iodine purifies and iodizes the air in a beneficial manner.

When the glands are white and hard, all hopes of curing them by medical treatment are at an end; excision is the only thing to do. For this purpose the guillotine (Fig. 206) is the best instrument to

Removal of the tonsil.

FIG. 206.



Guillotine prepared for use.

employ when it is at hand, otherwise a pair of vulsellum forceps and a bistoury must be used, guarding the base of the latter with lint or strapping to protect the lips (Fig. 208).

FIG. 207.



Operation on tonsil with guillotine.

FIG. 208.



Removal of tonsil with knife.

Calculus in the Tonsil.

In 1860 such a case came under my care. A man, æt. 38, after having suffered from enlargement of the right tonsil for a year and a half, expectorated a calculus the size of a nut, the expulsion of it having been preceded for three days by severe local pain and immediately beforehand the sensation of something having given way in the parts. When I saw him there was a distinct cavity in the tonsil. The stone was hard and ragged, and appeared to be made up of phosphatic salts; but the patient claimed the stone, and therefore it was not examined. Small calculi, the size of mustard seeds, are more common, and are supposed to be calcified tuberculous deposits. In Guy's Hosp. Mus. (Prep. 1677[50]) there is a specimen analysed by Dr. Babington, which consisted of phosphate of lime.

Calculus in the tonsil.

Cancer of the Tonsil.

Cancer of the tonsil.

This rapidly fatal affection happily is rare, and has not received much attention. It may appear as a primary or secondary affection, and in

Varieties.

the encephaloid or fibrous form. The *former* being the more frequent and rapid in its course, destroys life mechanically by secondary glandular enlargement, as well as by pharyngeal and laryngeal obstruction. The latter is seen mostly as an ulceration, and proves fatal by exhaustion. I have in one case seen this disease cause death by sudden and violent hæmorrhage owing to extension to and perforation of the internal carotid artery.

Characters.

This affection begins as an ordinary enlargement of the gland, but is more rapid in its growth, and is mostly attended by early enlargement of the lymphatic glands at the angle of the jaw, and subsequently of those of the neck. When it ulcerates, the ulcer assumes the indurated jagged appearance of a cancerous sore, not unlike the deep syphilitic sore after the breaking down of a gummy tumour. It has, however, a more indurated base and border than the syphilitic. It attacks men mostly of middle age, but I have had under my care a sweep only seventeen years of age, with the hard form.

Treatment palliative.

TREATMENT.—Palliative treatment is probably the best to adopt, although Dr. Cheever, of Boston, has proved that the tonsil may be successfully extirpated by external incision ('Boston Med. Surg. Journ.,' 1871). Its removal from within seems almost hopeless, whether by caustics—Maissonneuve's plan—the ecraseur, or enucleation. I attempted the latter in one case only with partial success—and the operation prolonged life.

Cheever's mode of excision.

Dr. Cheever performed his operation through an incision made below the angle of the jaw of three and a half inches, along the anterior border of the sterno-mastoid muscle, with a second incision extending along the lower border of the jaw. The flaps were reflected and a large gland enucleated. The digastric, stylo-hyoid, and stylo-glossus muscles were cut—the fibres of the superior constrictor being divided upon a director. The pharynx was opened. The finger of the operator was then swept round the diseased tonsillitic mass, which was enucleated. The hæmorrhage was free though not excessive, and twelve ligatures were applied. A steady convalescence followed. "The facility," adds Dr. Cheever, "with which the tonsil can be enucleated with the finger is surprising." This operation has been frequently repeated, and with enough success to justify its performance in cases in which the glands are not too far involved. For further information on this subject, reference may be made to the article "Amygdales, No. 2" 'Dictionnaire de Medecine,' 1865, and to Poland's article, 'Brit. and Foreign Review,' April, 1872.

CHAPTER XIII.

DISEASES OF THE GUMS, JAWS, TEETH, PHARYNX, AND ŒSOPHAGUS.

Hypertrophy of the Gums.

Cases of this nature have been recorded by Salter, Gross, Heath, and others, and they are said to be congenital. The disease may be general or local, and for its cure nothing less than its excision, with the affected alveolus, is of any use, the gum dipping down into the sockets of the teeth in the same way as other periosteal growths are seen to do.

Polypus.

Polypus of the gum, or outgrowths of gum structure, are due to the irritation of carious teeth or to uncleanly habits. They can be cured by the removal of the growth and its cause.

Vascular tumours.

Vascular tumours are met with on the gums, and generally between the front teeth. They are sometimes, but not always, associated with carious teeth. The outgrowth is usually small and more or less pedunculated, bleeding on the slightest manipulation. The vascular tumour occasionally presents more the features of a nævus. I have destroyed many of these growths by means of the galvanic cautery with success, but they can be removed by the knife or any caustic. When a carious tooth appears to be the cause of the disease it should be at once removed.

Cancerous epulis.

A cancerous disease of the gums puts on precisely similar appearances to those seen in similar diseases of the fauces, face, or tongue—an irregular, excavated, ulcerating surface, discharging fœtid pus, associated with pain, and glandular enlargement. Most of the cases of cancerous epulis are epithelial. The benign form of epulis is generally an affection of young life, and the cancerous of the old and middle-aged.

Inflammation and ulceration of the gums is met with in children, the result of stomatitis, and in adults from other causes. It always occurs in cachectic subjects, and must be treated generally.

Alveolar abscess

Abscesses about the gums are very common, and are frequently the result of disease of the teeth. Dentists tell us, however, that these "gum-boils" rarely induce any disease of the bone, though they sometimes arise from it. When connected with a carious tooth, and are of long standing, nothing but the removal of the tooth will effect a cure. A free incision, however, into the inflamed gum generally gives relief, cuts short the disease, and may save a tooth; it may, moreover, prevent burrowing and much further trouble. When associated with disease such as "necrosis," or death of the bone, the removal of the dead portion is an absolute necessity.

Necrosis of the Jaws.

Statistics of necrosis of jaw.

Necrosis may take place as a result of ostitis or periostitis, or it may follow a fracture. It is well known to follow an exanthem, and to be brought about by the fumes of phosphorus or of mercury. It is found in both upper and lower jaws. An analysis of fifty consecutive cases shows that nineteen were in the upper, twenty-nine in the lower, and two in both, thus controverting the assertion of Stanley, which has been repeated by others, that necrosis of the upper jaw is rare. It may show

Period of life.

Part attacked.

itself at any period of life. I have seen it in an infant a fortnight old, although it is more common in the young and middle-aged than in the aged. It may attack any portion of the bones, and even the condyloid processes of the lower jaw may die and be removed, leaving a moveable jaw by the spontaneous formation of a new joint. The child, æt. 8, from whom I removed the bone, illustrated below (Fig. 209), could move the jaw as well as if the condyle had never been destroyed, and,

Fig. 209.



Portion of lower jaw removed for necrosis from a child æt. 8, the movements of the jaw subsequently being perfectly regained.

in 'Guy's Hosp. Rep.' for 1869, I recorded another similar case. After necrosis of the upper jaw there is little or no osseous repair to be expected; in the lower jaw it may be very complete.

Is preceded by inflammation.

Necrosis of a bone is always preceded by symptoms of inflammation, such as swelling and pain, followed rapidly by suppuration, and the formation of sinuses leading down to the bone, which may be felt by a probe. A single sinus below the jaw or in the neighbourhood may be due to the presence of a diseased tooth.

Exanthematous necrosis.

Necrosis is likewise a common affection as the consequence of some fever or exanthem, and this fact is now fairly recognised. It is more common in children than in adults. As a rule it appears on the decline of the fever, with pain and swelling about some portion of the gums, and rapidly passes on to suppuration and death of the bone. The necrosis, however, is generally confined to the alveolus, in exceptional instances only it involves the body of the bone. Both jaws are equally liable to the affection. In the 'Guy's Hosp. Reports' for 1860 I recorded a series of cases to illustrate these points. In one case, narrated in detail, that of a woman, æt. 25, who in infancy had lost a large portion of her upper jaw after measles—the lower jaw had grown up to fill in the deficiency in the upper. It was nearly one inch higher in its vertical measurement on the right side than the left; it seemed, indeed, as if the lower jaw had grown upwards for want of the regulating influence of the natural pressure which the teeth of the upper jaw must exert upon those of the lower when in contact with them. I have recently seen a similar case where the increase of growth had taken place in the upper jaw, in consequence of a deficiency in the lower.

Compensatory growth of one jaw after necrosis of the other.

Phosphorous necrosis.

Necrosis of the jaws, as a result of the phosphorus poison, is now rarely seen, in consequence of the common phosphorus being less frequently employed than formerly in the making of lucifer matches. Dr. Bristowe, in his report to the Privy Council in 1863, clearly showed that it is to its influence the disease is to be attributed, *the amorphous phosphorus* being harmless. The first notice of the affection in this country was by my colleague Dr. Wilks, in the 'Guy's Hosp. Rep.'

1847, page 163. The disease is acute in every sense. It may involve a part only, or the whole of the upper or lower jaw, both seeming to be equally liable to the affection; but in the majority of cases the teeth of the affected bone are more or less diseased or deficient. It is a rare thing to find the disease in subjects who have sound teeth, or in those who have a complete set. Some openings down to the bone, either through carious or deficient teeth, appear to be necessary to enable the phosphorus fumes to act upon the bone. Dr. J. Wood, of New York, records a case in which the whole bone died and was restored. The disease begins for the most part by a general aching of the teeth, followed by rapid suppuration and necrosis of the affected bone. The constitutional are usually as severe as the local symptoms. Symptoms. Progress of disease.

TREATMENT.—When dead bone can be detected, either in the upper or lower jaw, its removal is the only one form of practice which ought to be entertained, and this should be effected by the mouth with as little disturbance as possible to the soft parts, or to the new bone-forming tissues, such as the periosteum. When external incisions are necessary they should be made where afterwards they will be little seen. Treatment of necrosis.

In necrosis of the *upper* jaw the bone can nearly always be removed by means of incisions made *beneath* the cheek. An incision *through* the cheek never seems necessary. In necrosis of the *lower* jaw, when incisions through the integument are demanded, they should be made below the lower border of the bone. When the dead bone is fixed, or rather before it has been thrown off from its attachments and before a new casing of bone has been formed, all operative interference must be condemned, particularly in the lower jaw, as there seems little room to doubt that the muscles, acting upon the new bone before it has become consolidated, may alter its shape and produce deformity. Under these circumstances, the Surgeon should content himself with seeing that all pent-up pus has free exit, by means of incisions through the gum, also that the patient's mouth is kept as clean as possible by frequent washing, and that his general condition is maintained by means of tonic medicine and nutritious diet. When the necrosis is confined to the alveolus in which the temporary teeth are situated, great care should be taken that the parts beneath are not disturbed, and that the permanent teeth are not interfered with. Even when exposed these permanent teeth need not of necessity be removed. In young patients where much loss of bone has taken place, it seems desirable to have some artificial substitute, in order to prevent the occurrence of such an overgrowth of the opposing jaw as took place in the cases already referred to. Where the antrum is exposed by exfoliation, much may be done by the dentist to fill in the gap. At times also, the fistulous opening takes place externally; thus, in 1864, I was called on to treat a woman, æt. 34, who nine years previously had had extensive necrosis of the upper jaw, and, as a consequence, a fistulous opening the size of a sixpence was left below the right eye, communicating directly with the antrum. The soft parts were firmly connected with its margins, and the lower lid drawn down. I raised the integument from the bone by making free subcutaneous incisions, pared the edges of the flaps, and brought them together over the opening in the bone. Good union followed and the deformity was removed. Of upper jaw. Of lower jaw. When confined to the alveolus. Where antrum exposed. Where fistulous openings remain.

Epulis.

Under this term "epulis" are included, rightly or wrongly, most of On epulis.

Varieties. the tumours of the gums—polypoid or diffused—simple outgrowths from the gums, due to the irritation of a carious tooth or stump, papillary, fibrous, fibroplastic, myeloid, epithelial, and cancerous tumours.

The true form The true or fibrous, fibroplastic, and myeloid epulis (for these elements enter in different proportions into all the benign forms of epulis) are diseases chiefly of the periosteum (Fig. 210), and are rarely cured without

Fig. 210.



Fibrous epulis from gum. Drawing, Guy's Hosp. Mus., 171[10]. Mr. Birkett's case.

removal, together with the portion of bone upon which they are placed, since the growth dips down into the sockets of the teeth about which it springs. At times, however, they invade the bone itself (Fig. 211), the endosteal membrane which lines the bone being continuous with the periosteal covering it. They appear as simple fleshy outgrowths of

Characters.

Fig. 211.



Epulis springing from bone. Mr. Key's case.

Fig. 212.



Front view of tumour of alveolus. Due to hypertrophy and dilatation of tooth sac.

the gum about a tooth, and develope into a large mass of a firm or semi-elastic tissue. At a later stage this mass may ulcerate and break down.

Case of odontome of upper incisor tooth. In exceptional cases a tumour that appears to be an epulis results

Fig. 213.



Odontome after removal.

Fig. 214.



Section of odontome, showing expanded thickened root of incisor tooth.

from the abnormal development of a tooth; this was the case in a boy, æt. 11, from which Fig. 212 was taken, the expansion of the

alveolus having been brought about by the development of an odontome of the root fang of an upper incisor tooth which had been growing for three or four years.

Fig. 212 illustrates the swelling of the gum before the removal of the disease, Fig. 213 the tumour on its removal, and Fig. 214 the same in section. My friends, Messrs. Salter and Moon, informed me that this is a unique case. In the diagnosis of such a case the protrusion of the crown of the tooth becomes a valuable guide.

Mode of removal.

TREATMENT.—The removal of the disease of the teeth or stumps that are involved in it, as well as of the bones with which it is connected, is the only sound practice to adopt. A good pair of cutting pliers, which will nip off as much of the alveolar process as seems involved, is the best instrument to use, a small hand saw having marked out vertically the limit of the incision. When the bone is not removed a return of the disease is almost certain.

Tumours of the Jaws.

Tumours of the jaw.

Some of the most remarkable tumours of these bones are due to hypertrophy or hyperostosis—the lower jaw with other bones of the face and head being generally involved. Mr. Howship's well-known case of disease of the upper jaw, which is noticed everywhere, is a case in point; so is that of Mr. Bickersteth's, which was exhibited at the Pathological Society in 1866, and which he described with all minuteness in the 'Transactions' of the year. The disease is usually symmetrical, showing itself as a uniform enlargement of the bones involved—the upper jaws projecting as two large globular masses. When the ascending ramus of the lower jaw becomes hypertrophied and elongated, a curious one-sided deformity of the face exists.

Hypertrophy.

Cystic Disease of the Antrum.

Diseases of antrum.

This is a special affection and often connected with irregular dentition; though how often has not yet been determined.

Suppuration of cavity.

Suppuration of the cavity is often due, doubtless, to an extension of inflammation from the teeth, and may arise from a blow or other cause. It is known by severe local pain, extending over the face and forehead, local swelling, and extreme tenderness, the constitutional symptoms being often very severe. When pus has formed there may be rigors, and the abscess may burst either into the nose or into the mouth beneath the cheek—the antrum, under these circumstances, becoming much distended. In rare cases it may make its way through the cheek, and in one where this occurred, an opening into the antrum the size of a fourpenny piece was found, on making an incision down in the bone beneath the cheek. In neglected instances, the floor of the orbit may be displaced and vision interfered with, or even destroyed. (*Vide* Salter, 'Med.-Chir. Trans.,' 1863.)

Treatment of suppuration of antrum.

TREATMENT.—When suppuration has been made out, the antrum should be opened, and if its anterior wall be expanded, an opening may also be made into it without fear at the most projecting point with a trocar or other sharp instrument. The relief given by these means is very signal. In one case of a lady that came under my care some years ago, it was instantaneous and permanent. When diseased teeth are present in the bone, they should all be tested by a sharp blow, and the most tender removed. A jet of ether spray on each tooth will prove an admirable test, the cold searching out the slightest disease.

It is never advisable to remove sound teeth unless some evidence exists of their alveoli being diseased. In all these cases the cavity must be kept clean by syringing. A chronic abscess in the antrum may be so insidious in its formation as to induce the Surgeon to believe that a tumour exists. Liston gives an instance in his 'Practical Surgery' of such an error, in which removal of the jaw was attempted. In all tumours of the upper jaw, the probability of the presence of a large cyst should never be forgotten.

Hydrops antri.

Hydrops Antri.—Under this term is grouped a number of cases, which include examples of cysts of the antrum, cysts of its wall, and cysts placed outside the bone, and all are characterised by a gradual, painless expansion of the part, which rarely produces other symptoms than those due to mechanical pressure. The swelling may encroach on the nose, and cause obstruction; on the orbit, and press on the globe; on the mouth, and produce bulging of the palate; and, on the cheek, so as to cause deformity; indeed, it is often because of this that the patient is induced to seek advice. When the expansion is great, the shell of bone may become so thin as to crackle like parchment under pressure, or to appear as if only membranes. M. Giraldès, in 1853 (Montyon prize), was the first to describe these cysts with clearness, although Mr. W. Adams had previously recognised them. (*Vide* 'St. Thomas's Hospital Museum Catalogue.') The old Surgeons looked upon this affection as the result of obstruction to the aperture between the nostril and antrum, the dilatation of the bone being due to retained mucus, but this is now known to be an error. Giraldès regards these cysts as dilatations of the glandular follicles of the mucous membrane. The fluid contents of these cysts are always viscid, occasionally clear, but mostly blood-stained, sometimes purulent, containing cholesterine, but never pure mucus. In 1878, I had a case in a boy æt. 16, with the late Mr. R. Phillips, of Leinster Square, where the fluid was serous and blood-stained in a high degree.

The *lower jaw* may likewise be the seat of a simple cystic tumour or expansion. In 1875, I had such a case in a woman, æt. 42, in whom the cyst had expanded the ascending as well as part of the horizontal ramus, and it contained no growth. The preparation is in the Guy's Museum, 1091.

Dentigerous cysts.

Dentigerous cysts are, clinically, closely allied to those just described; pathologically they may differ; but there can be no doubt that the cysts are connected with the teeth, which are in some cases fully developed, and in others imperfectly so. They are found in both upper and lower jaws. Heath, in his excellent 'Essay on the Jaws,' 3rd edit. 1884, informs us that cysts of small size, in connection with the fangs of permanent teeth, are frequently found on extracting the latter, but give rise to no symptoms demanding surgical interference. Occasionally growing to a large size they produce absorption of the containing alveolus, and give rise to a prominent swelling. The disease is generally slow in its progress, and tolerably painless; by its pressure the cyst may cause absorption of the bone with which it is in contact, and lead to a deep excavation. Paget relates in his 'Surgical Pathology' such a case as a cyst near the gums, and I have had under observation a woman who had a tumour in her left cheek for years, which when opened, discharged some watery fluid. She applied to me for a bony projection of the cheek, that was clearly the edge of the alveolar process of the upper jaw, the bone above having become absorbed by the pressure of

Symptoms and progress.

s causing a cup-like depression. She had had all her
l at different times by dentists, under the impression that
as due to them.

erous cysts are found in both jaws, and are almost always Cysts connected with undeveloped teeth.
th the permanent teeth, rare cases being recorded in
mporary were implicated. In this affection, the teeth
pment and remain within the jaw, the tooth acts as a
, sets up ir-
causes the
on I am now
r some solid
as, in a boy,
ne under my
ears ago, a
ment of the
years' de-
isted. It en-
the orbit,
heek. I made
ng into the
of the cyst,
and, through

Examples.

Fig. 215.



Tooth as seen through opening in upper jaw. Natural size of tooth when removed.

r tooth was seen with its crown upwards (Fig. 215). The
moved and a good recovery ensued. In January, 1872, I
ilar case in a girl, æt.
e by Mr. Salter, who
r observation for two
sease was in the right
nd the right canine
icient. I exposed the
removed the tooth
growing in an abnor-
n upwards and in-
ood recovery taking
uly 24th, 1875, I tre-
our of the lower jaw,
four years' growth, of
. 30, a patient of Mr.
f Norwood, and also
r's, and removed from
oth which was resting
the cavity (Fig. 216).
as collected many si-
It is well to remember
entigerous cysts, like
f the jaws, may simu-
umours. When they
lower jaw and expand
is error is very likely
e. Thus, in 1881 a

Fig. 216.



Canine tooth as seen in case of Miss R—, in expanded lower jaw with tooth (*b*) of its natural size. *a*. Bone removed by the trephine.

t. 58, came to me with an enlargement of the left hori-
of his lower jaw, which had been coming on for years,
s there was a little discharge from his gums. I explored

this and struck a tooth, which Mr. Moore skilfully removed. It was a molar tooth, which was lying horizontally in the bone, with its crown forward, and its fangs grasping those of the last molar. In all tumours of the jaws that have a smooth or cystic outline it is well to make an exploratory puncture for the purpose of diagnosis. When the walls crackle from the thinness of the expanded cavity the diagnosis is simple.

Treatment of dentigerous cysts.

TREATMENT.—The free opening of the cyst, with the extraction of any tooth that may be present in it, is the one essential point of practice to observe in all these cystic diseases of the jaws, upper or lower. This can be done with a knife or a sharp pair of forceps, after a perforating wound has been made by a trephine, drill, gouge, or pointed instrument. To induce suppuration of the cyst, it is a good practice to plug the cavity with lint. When the cavity is large, it is wise to take away a considerable portion of its wall. Removal of a segment of bone for cystic disease is rarely needed. Before, however, the pathology was understood this malpractice was often perpetrated, as our different museums too truly testify.

Dentigerous tumours.

Dentigerous tumours may likewise occur. In Fig. 217 is illustrated a case in which I removed the upper jaw of a child, æt. 8, for a nearly solid myeloid tumour of the jaw clearly originating in a malplaced tooth which was growing from the posterior part of the orbital plate of the bone; one or two cysts existed in the growth enough to allow of its being called cystic. There was no possibility of making a diagnosis in this instance; such examples are very rare.

FIG. 217.



Dentigerous tumour of jaw.

Tumours of the Jaws.

These are of different kinds, simple and malignant, connected and unconnected with teeth. When in the antrum, their dental origin should be suspected, but in both upper and lower jaws solid tumours of all kinds have been found with teeth as their centres.

Polypi of the antrum.

Polypi of the antrum—as are those of the nose—are occasionally met with, and they show themselves mostly as projections into and through the nostril, the tumour making its way through the nasal wall of the antrum, and, at the same time, generally expanding its facial wall. I

Examples.

have seen four well-marked cases of this sort, and in two the whole mass was removed through the nostril, which was laid open, and turned back. In the third, the cheek was reflected outwards at the same time, and a large opening made into the antrum allowing the Surgeon to scoop out the growth. Two of these cases occurred in the practice of Mr. Cock, and two in my own. The constant flow from the nostril of the affected side of a quantity of clear fluid is a valuable symptom of these growths, as shown by Paget's case ('Clin. Soc. Trans.,' 1879).

Tumours of the upper jaw.

Tumours of the Upper Jaw.—Weber, quoted by Heath, informs us that in an analysis of 307 cases of tumours of the upper jaw, more than one third of the whole number may be set down as

Varieties.

sarcomatous simple tumours, one third as osseous, and less than one third cancerous, the myeloid being included in the first of these groups. They may grow also from any part of the bone or periosteum. When they originate in the antrum they expand its cavity,

as is the case in the cystic disease, and cause a bulging of one or more of its walls. When they spring from a surface or plate, the tumour will project from it, leaving the other surfaces unaffected. The fibrous in all its forms and the osseous are usually of slow growth. They are often painless, and trouble only from their size. The sarcomatous, myeloid, and cancerous are of more rapid growth. The fibrous or sarcomatous are usually periosteal growths, the osseous and myeloid endosteal. The cancerous may belong to both. The cartilaginous are very variable in their progress, now very slow and then rapid. They are chiefly of the mixed kind, fibre tissue largely predominating in tumours of slow formation. They frequently involve many bones. Sir J. Paget ('Surgical Path.') states, that in the only case on record of enchondroma of the upper jaw alone, the disease was removed by Mr. Morgan—late of Guy's—from a man æt. 24; the tumour was of the right maxilla and was of nine years' growth. The patient survived the operation seven years. Figs. 218 and 219 illustrate the case; the

The fibrous.

The sarcomatous.

The cartilaginous.

Fig. 218.



Fig. 219.



Enchondroma of upper jaw.

Before operation. Model, Guy's Hosp. Mus., 38^{10}. After death. Model, Guy's Hosp. Mus., 38^{12}.

first being taken before Mr. Morgan's operation and the second after the patient's death. Dr. Heyfelder, of Munich, says, however, that he found eight such cases out of 450 of disease of the upper jaw.

Treatment.—All solid tumours of the upper jaw must be extirpated, but not more of the bone should be removed than is necessary. Sir W. Fergusson established this rule in practice, and it is one that all surgeons should strive to follow. Thus, when the disease springs and projects from the facial surface of the bone, the tumour, with the facial plate alone, requires excision. When the alveolar process is alone implicated, the other portions of the bone must not be touched. Where possible, the palate plate should be preserved, and it is bad surgery to interfere with the orbital plate without an absolute necessity. When the whole bone is involved in the disease, it must be removed, but such cases are exceptional. In many cases where the disease originates in the antrum, a

Treatment of tumours of upper jaw.

partial removal of the bone will suffice, if the surgeon can at first only lay open the cavity and find out the base of the growth. For perforating the antrum with a view to exploration Sir W. Fergusson recommends an ordinary carpenter's gimlet.

Excision of part or whole of upper jaw.

Operation for the Removal of part or the whole of the Upper Jaw.—The incision now almost universally adopted for the removal of tumours from the upper jaw is the one of Sir W. Fergusson (Fig. 220); as by it all the necessary room is given to remove even the largest growth. The facial nerve and artery are divided, where by their size, they are of small consequence, and the scars are so placed as to become almost imperceptible. In tumours of *moderate* size, the incision should be carried through the median line of the lip into the nostril, when, by raising the nostril and retracting the cheek outwards, abundant room is obtained. When more room is required, the operator may extend his incision round the ala and up the side of the nose towards the inner canthus, and if this is still insufficient, a third incision may be made from the termination of the second along the lower border of the orbit.

Description of the operation.

Different incisions.

FIG. 220.



Fergusson's incision for removal of upper jaw.

FIG. 221.



The dotted line, *a*, Gensoul's incision; *b*, Lizar's and Liston's.

These incisions are indicated in Fig. 220, which was taken from a man æt. 35, from whom I removed an osteo-chondroma, of twelve years' duration, involving the facial and palate plates of the superior maxilla. The dark line indicates the incision made; the dotted extra line that which may be required in exceptional instances. Fig. 221 illustrates Gensoul's and Liston's method.

In some cases, the ala of the nose alone may be turned up. I removed a fibrous tumour growing from the nasal process of the superior maxilla by this incision, and found ample room. The incision having been made, and integument reflected sufficiently to expose the tumour, all bleeding should be stopped by ligature or torsion. Assuming that the whole bone has to be removed, the incisor tooth of the affected side must be extracted, and the palate plate of the upper jaw with the alveolus divided with a fine saw (Fig. 222) introduced into the nostril. The malar process of the maxillary bone is then to be partially sawn through, as well as the nasal process of the superior max-

FIG. 222.

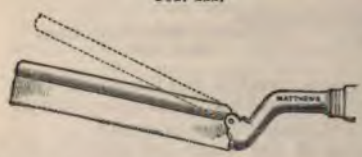


FIG. 223.



Lion forceps.

illa, their complete section being made with bone forceps. The tumour should then be seized with the Lion forceps (Fig. 223), and the whole wrenched off, bone forceps and scissors being employed to complete any section that may be required. The infraorbital nerve should be divided with scissors, and the soft palate left as little injured as possible. If any portions of the disease remain they can now be removed. All bleeding vessels are to be treated by ligature, torsion, actual cautery, or styptics, and the parts carefully brought together with interrupted sutures. Removal of bone.

When the disease, says Heath, is of less amount and the orbital plate not involved, this should be preserved by carrying a saw horizontally *below* it; and if the palate be not involved, this may be advantageously kept intact by making a similar cut immediately *above* it. Sir W. Fergusson advises that the disease should be cleared out from the centre towards the circumference, so as not to remove healthy structures unnecessarily, and this may be readily accomplished by means of the many forms of curved bone forceps with which surgeons are now familiar, aided by the gouge.

In a case of myeloid disease of the upper jaw involving the whole of the hard palate, I peeled off all the soft parts from the bone, beginning at the alveolus, and, having removed the diseased bone, brought them up again in position and fixed them to the mucous membrane of the cheek where it had been separated from the bone. By this means I preserved the roof of the mouth from the first, and, what is more, eventually obtained an excellent new palate. The practice, particularly in young subjects, is probably worth following. Practical hints.

FIG. 224.



Periosteal sarcoma of lower jaw

View of section. External aspect of tumour.

Tumours of the lower jaw grow to enormous dimensions and pathologically are very similar to those of the upper. The fibrous in one of its forms is probably the most common, the periosteal tumour being more frequent than the endosteal. The latter may occupy the dental canal as illustrated by a case of Mr. Cock's (Guy's Hosp. Mus., 1091[25]), in which the dental nerve passed through the tumour. The periosteal growth is often an epulis, and a good example of this form is represented in Fig. 209. But a more typical example of a true periosteal sarcoma which I removed in 1872, from a girl æt. 20, is illustrated in Fig. 224. The tumour was of three months' growth. It returned three months after removal, and destroyed life by suffocation, having Tumours of the lower jaw.

grown to the size of the patient's head. Microscopically the tumour was a spindle-celled periosteal sarcoma. One of the largest fibro-cellular tumours of the bone on record occurred in Mr. Heath's practice, and is illustrated, with his permission, in fig. 225. It was removed from a man æt. 32, and the disease was of eleven years' growth. It weighed 4 lb. 6 oz.; the man died from exhaustion on the sixth day.

FIG. 225.



Fibro-cellular tumour of the lower jaw. Mr. Heath's case.

Fibro-cystic tumours.

Fibro-cystic tumours of the lower jaw are very common, and have the same clinical history and aspect as the cystic tumours to which attention has been already directed. The most beautiful example on record is that which was removed by the late Dr. Hutton of the Richmond Hospital, Dublin, and is illustrated in Heath's book; it was made up of cysts of nine years' growth, and in a young woman only 20. A yet more remarkable case was operated upon by Mr. Key in 1841, in a boy æt. 13 (Figs. 226, 227). The tumour was of two years' growth and painless. Mr. Key removed the whole by sawing through the lower jaw just below the angle on each side, and a good recovery ensued. Mr. Eve in his excellent lectures at the College of Surgeons in 1882 strove to show that these cystic tumours of the lower jaw are in their origin examples of epithelioma.

FIG. 226.



FIG. 227.



Fibro-cystic disease of lower jaw.
Guy's Hosp. Mus., Drawing 4[87]. Key's case, during life. Guy's Hosp. Mus., 1090[20]. Key's case. Tumour after removal.

Cartilaginous growths.

Cartilaginous growths are uncommon, and occur in early life, and as already stated are periosteal and endosteal. A fine example of the latter can be seen in Prep. 1091[15] and [16], Guy's Hos. Mus., which Mr. Key removed in 1846, from a woman æt. 29, in whom the disease had been coming on for nine years. In the preparation, the fibro-cartilaginous substance is seen to be placed between the plates of bone of the jaw, the teeth being in the middle of the new growth. The periosteal tumour grows to a large size.

Osseous tumours.

Osseous tumours are sometimes the result of ossified enchondroma

There is in St. Thomas's Museum a specimen of this kind which was removed by Mr. Cline. Bone may, however, occur as an independent growth in the form of cancellated or ivory exostosis, which may sometimes grow to a large size. Other troubles may spring from such a growth; for example, in March, 1877, I had to remove a portion of the lower jaw from a lady æt. 50, who had had an exostosis growing for twenty years from its inner surface at a point corresponding to the right bicuspid and canine teeth. The growth had not given rise to any trouble till the soft parts covering its apex had begun to ulcerate, when, from its roughened surface, the bone so irritated the floor of the mouth as to set up ulceration which was thought to be cancerous. I removed the exostosis with the bone and then reached the supposed cancer, which I isolated by needles passed through the base of the growth, and removed by means of the galvanic écraseur. A good result followed, and the lady is now well.

Sarcomatous tumours are met with in great variety, the softer kinds being recurrent and clinically malignant. Some of the very vascular pulsate.

Cancerous tumours are mostly periosteal and invade the bone by extension. They are of the epithelial form when attacking the gums and mucous membrane, and of the tubular variety in the nose and antrum, when originating where the epithelium is columnar.

Treatment of tumours of lower jaw.

TREATMENT.—Tumours of the lower jaw, as of the upper, are to be treated by excision, and the operation, though large, is most successful. I have on more than thirty occasions removed large portions of the jaws with but one death, and that was from inflammation of the lungs. Heath says that Mr. Cusack removed large portions in seven cases with only one fatal result, and Dupuytren operated in twenty with only one death. Sir W. Fergusson, Syme, and Liston's success is well known.

When small.

Small tumours of the jaw, and particularly of the alveolus, may, with good cutting forceps, be removed from the mouth. If more room be required an incision may be made outwards or downwards at the angle of the mouth. On many occasions I have obtained all the room I required by making a horizontal incision below the level of the jaw, and a dissection of the soft parts off the bone.

Mr. Maunder has shown that large portions of the lower jaw the seat of tumour may be taken away without external incision after detaching periosteum by means of the raspatory.

When large.

Operation of excision.

When a large tumour has to be removed, it may readily be exposed by a curved incision carried along the posterior surface of the tumour from above the angle of the jaw to the median line, turning the soft parts up. In doing this the facial artery will be divided, when the two ends should be at once secured by torsion; the knife, says Fergusson, should be so lightly carried over the artery that the vessels need not be divided till the flap is being raised. In this way blood is saved. The labial margin of the lip rarely need be divided. The tumour having been exposed, its surface must be well examined, with the view to the removal of the growth by cutting away the external plate of bone which covers it in, by means of the gouge and bone forceps. This step is wise in doubtful cases, as a large number of tumours of the jaw, particularly the cystic, may be scooped out, and recovery will ensue. If the tumour and jaw require excision a tooth must be extracted in front where the bone is to be divided and a small

saw applied; after which the bone should be grasped with the Lion forceps and drawn outwards, the Surgeon subsequently carefully dividing all the soft parts that hold it in position on its inner surface, and keeping the knife *close to the bone*. When the disease stops at the angle the saw and forceps are again to be applied and the tumour removed. Where disarticulation is required on account of the extension of the disease, the jaw must be forcibly depressed, so as to bring the coronoid process within reach, and allow of the division of the insertion of the temporal muscle. The condyle may then be twisted out, the knife dividing cautiously the insertion of the external pterygoid and such ligamentous fibres as are put on the stretch. Fergusson says that in doing this he found that the condyle actually separated from the periosteum on its inner side, thus facilitating its removal, and in two cases of my own I found this to occur; in one after the division of the periosteum with the knife. When the tumour is so large as to be wedged in and to prevent this mode of dislocation, the best plan is to re-apply the saw and cut off the tumour as high as may be, and subsequently to remove the remaining portion of jaw.

When dis-articulation required.

When central portion removed.

When the central portion of the lower jaw is removed there is danger of the tongue falling back, and causing suffocation; to prevent this a ligature may be passed through the tip of the tongue and held during the operation, and on the completion of the operation fastened to the wound. The ligature should be removed on the second or third day.

After the operation all arterial bleeding should be stopped, and any oozing arrested by the application of a sponge wrung out of hot iodine water; the edges of the wound should be brought together by interrupted sutures. Convalescence is generally rapid and recovery complete. The deformity that follows the operation is in most cases so slight as not to be observed; the interval left by removal of bone is filled with dense fibre tissue. Bone is never reproduced, but the tissues soon become firm enough to bear the support of artificial teeth.

The half-sitting position is probably the best in all these operations on the jaws; and chloroform may be given without fear. For more details connected with this subject the student may refer to Heath's admirable 'Monograph on the Jaws;' Fergusson's 'Surgery;' Liston's paper, 'Med.-Chir. Trans.,' vol. xx, and his 'Pract. Surgery.'

Disease of the articulation.

Disease of the temporo-maxillary articulation is rarely met with, more rarely, indeed, than disease of any joint in the body. Of the few examples of it I have seen one was in a woman, æt. 34, who had had it for nine years, suppuration having existed for six; several sinuses lead down to the joint, and the jaw was nearly fixed; dead bone appeared to be present, but the patient refused to have any surgical interference. Another case was a girl, æt. 18, in whom both sides of the lower jaw were completely anchylosed. In Guy's Hosp. Museum there is also a splendid specimen, No. 1070, of complete synostosis of the articulation.

The cases already quoted of necrosis of the condyloid process of the lower jaw, and recovery with a sound joint, may here be referred to.

Closure of jaws.

Causes.

Closure of the jaws may be caused by some spasmodic condition of the muscles of the jaw secondary to disease of the teeth, or to the cutting of the wisdom teeth. In the latter case the mouth must be forced open under chloroform, by means of the screw gag or wedges, and the tooth removed, or, what is better, room made for it to come forward by the

extraction of a neighbouring molar. It may likewise be caused by anchylosis, or by the contraction of cicatrices, either within or without the mouth. In February, 1878, I operated upon a woman, æt. 43, who for thirty-seven years had had her jaws locked from adhesions between the cheeks and gums, which had compelled her to live on liquid food for the whole of this period. I divided the cicatrices and opened the jaws with a promise of a good recovery. Two years later she could take and masticate food. The condition had followed scarlet fever. Dr. S. Gross, in his 'System of Surgery,' informs us that ulcerative causes are the most common, and he attributes the majority to the evil practice of giving calomel to salivation. In rarer cases the immobility is occasioned by an osseous bridge extending from the lower jaw to the temporal bone, this condition being generally associated with chronic articular arthritis. "However induced," writes Gross, "the effect is not only inconvenient, seriously interfering with mastication and articulation, but it is often followed, especially if it occur early in life, by a stunted development of the jaw, exhibiting itself in marked shortening of the chin, and in an oblique direction of the front teeth."

Treatment of closure of jaws.

TREATMENT.—Where the cause is in the joint and cannot, as can dead bone, be removed, the Surgeon may attempt to break up the adhesions by forcibly opening the mouth under chloroform, or he may divide the bone below the joint. When due to cicatrices and nodular plastic matter, little good has ever been derived from their division, although in the case previously alluded to the result was satisfactory. Esmarch, of Kiel, in a paper 'On the Treatment of Closure of the Jaws from Cicatrices,' 1860, has, however, described an operation which the Messrs. Henry, C. Heath, MacCormac, Mason, Lawson, and Annandale in this country have practised with success enough to indicate its value.

Operation of removal of piece of jaw.

Operation.—This consists of the removal of a piece of the lower jaw for the formation of a new joint, and is to be carried out by making an incision along the lower border of the jaw, in front of the masseter, raising the integument, and removing with a hand or chain saw a wedge of bone, measuring about an inch above and a half-inch below. Where only one side of the jaw is affected, it is without doubt the best operation that can be performed, the patients recovering their masticatory power in two or three weeks. It must be mentioned that about the year 1860 Rizzoli, of Bologna, performed a somewhat similar operation to Esmarch's, dividing the jaw but not removing any portion of it.

Deformities of the jaws.

Deformities of the jaws are sometimes seen as a consequence of some disease of the tongue such as hypertrophy, the mechanical pressure of tumours during growth, the evil influence of cicatrices more particularly about the neck and mouth, and of various other causes. For these surgery may often do much, but when this fails, the dentist can often give relief. I have seen the upper jaw in at least six cases of torticollis nearly one inch less in its vertical diameter than the opposite bone, and I have already alluded to a case where the lower jaw was nearly an inch higher than natural, to make up for a deficiency in the teeth of the upper jaw which had existed from childhood.

Dislocation of the Jaw.

Dislocation of the jaw.

Varieties and causes.

This may involve one or both condyles, two out of every three cases being bilateral. It may be caused by direct violence on the jaw, but more frequently by yawning. Sir A. Cooper tells of a case in a child, where it was produced by the forcible introduction of an apple into

the mouth, and dentists know of its being produced even by the extraction of a tooth.

Symptoms of double dislocation.

In the *double* dislocation, the mouth is widely open, the jaw fixed and projecting, the lips separated, and, as a consequence, speech is very difficult. Deglutition is much interfered with, and the saliva flows from the open mouth. In front of the ear, a marked hollow will be perceptible, and *above* the zygoma, in the temporal fossa, an undue prominence (Fig. 228). Adams, of Dublin ('Dub. Quart. Journ. Med. Science,' vol. i), first noticed these symptoms, and Dr. R. W. Smith ('Fractures,' 1854) believes them to be caused by the "displacement and stretching of the fibres of the temporal muscle on the upper surface of the condyle."

FIG. 228.



Dislocation of lower jaw. Couper's case. 'London Hosp. Rep.,' 1864.

Single dislocation.

In the *single* dislocation, the chin is oblique, but usually directed towards the *sound* instead of towards the *injured* side, as in fracture of the neck of the bone. In exceptional cases, however, this is not to be observed. The other symptoms are similar to those of double dislocation, the hollow in front of the ear being the most characteristic.

Congenital dislocations.

Congenital dislocations have been described by Smith, Guerin, Langenbeck, and Canton. Sir A. Cooper has also drawn attention to *subluxation*, in which he assumed that the condyle of the jaw slipped in front of the interarticular fibro-cartilage. It is caused and characterised by the same conditions as those of dislocation, and it is probably a partial dislocation forwards.

Reduction of dislocations.

TREATMENT. — Partial dislocations or those described as subluxations, are usually reduced by the patients themselves, by some little lateral movement of the jaw, or, by gentle pressure upon the chin. Cases of complete dislocation have likewise been similarly reduced; but more frequently, the Surgeon's aid is demanded. To reduce the dislocation the Surgeon should stand in front of his patient, who should be seated in a chair with his head supported. The Surgeon should then introduce his thumbs well protected with a towel or lint into the patient's mouth upon the last lower molar teeth, and grasp the jaw with his outer fingers; he should next make pressure upon the teeth downwards and backwards, so as to depress the condyles from their false position, and at the next moment elevate the chin with the outer fingers (Fig. 229). Some surgeons prefer using a piece of wood or the handle of a fork introduced between the molar teeth to

FIG. 229.



Reduction of dislocation of lower jaw.

Mode of proceeding.

depress the jaws. When strong leverage is required, as in old cases, Stromeyer's forceps may be employed. Nélaton's advice to press directly upon the coronoid processes, and Pollock's practice of applying pressure upon the chin by means of Petit's tourniquet fixed upon the head, are worthy of attention. It is well to reduce both sides together; and old standing dislocations may be thus reduced. Mr. Morley reduced one after thirty-five days, Spät after fifty-eight; Demarquay after eighty-three, Donovan one after ninety-eight; Pollock after four months, and Golding-Bird after eighteen weeks.

Fracture of the Jaws.

Fractures of the upper jaw.

Fractures of the *upper jaw* are not nearly so frequent as those of the lower, and when they occur it is generally from direct violence; when the "key" was employed for the extraction of teeth, a fracture of the alveolus was frequently the result. In severe injuries, much displacement and copious hæmorrhage may take place. Cases are on record where the internal maxillary artery was ruptured and fatal results ensued. The infra-orbital nerve or its branches are occasionally injured when some loss of sensation in the cheek will be produced. I have known emphysema of the cheek or orbit to follow such an injury, and have seen sub-conjunctival hæmorrhage from it. One of the worst examples of fracture of the upper jaw I have seen, occurred in a man, æt. 30, from a fall from a height. Both upper jaws were completely detached from the skull, and could be moved about in any direction, yet a good recovery ensued. I saw a second in an asylum, and it was caused by the blow of a lunatic's fist. In this case the whole of the alveolar process of the right upper jaw was broken off, and the lower jaw fractured in two places.

Causes.

Treatment.

Treatment.—Where *no* displacement has taken place, little treatment is required; the parts should be left alone, for natural processes to effect a cure. When *displacement* exists, and can be remedied by manipulation, such means should be applied, some slight retentive bandage, with or without a pad, being employed to keep the parts in position. When the palate plate is much interfered with and displaced, the dentist's aid may be called into requisition, a gold plate well adapted to the parts tending to keep the fragments together; *vide* Salter, 'Lancet,' 1860. Hæmorrhage, as a rule, can be arrested by the application of ice or styptics. When the soft parts are injured and bleeding takes place from them, the vessel should be secured. When the bone is comminuted, there is no need for the removal of fragments; Malgaigne laid this down as a law, and Hamilton asserts that, owing to the extreme vascularity of the bones composing the upper jaw, the fragments have been found to unite after the most severe gunshot injuries. In rare cases of separation of the maxillæ, a spring passing behind the head and causing pressure upon the maxillæ, after the manner of Hainsby's harelip apparatus, Heath says, might be advantageously employed.

When comminuted.

Fractures of the lower jaw.

Fractures of the lower jaw, like those of the upper, are, as a rule, the result of direct violence, and, when produced by gunshot injuries, are, at times, most severe. They are almost always compound towards the mouth, as the gum tissues readily give way. The body of the bone is more frequently broken than any other part, although the ramus and the neck of the jaw may be fractured. The line of fracture is generally oblique, and very commonly near the canine tooth.

Generally compound.

Double fractures are very common, eleven out of twenty-four cases recorded by Hamilton being of this nature. Comminuted fractures are more rare. A case came under the care of Mr. Poland, at Guy's, in which the jaw, by the kick of a horse, was broken in five places.

Symptoms.

The symptoms of fracture are generally very clear, crepitus being often felt by the patient in attempting to move the jaw, and it is readily made out by the Surgeon. The irregularity of the teeth is also a very characteristic symptom, and the care of the patient to hold the parts in position, conjoined with his inability to speak, is a typical sign. When any doubt exists as to the presence of a fracture the mobility of the broken bones will disperse it. Considerable displacement sometimes complicates the case, the position and the line of fracture determine the degree; an oblique fracture near the insertion of a large muscle, as the masseter, necessarily shows a tendency to override. In double fracture of the body of the bone, this displacement is usually very marked, the muscles that connect the lower jaw with the hyoid bone drawing the lower portion down. In some cases this displacement cannot be completely remedied.

Teeth driven into jaw.

In rare cases the teeth may be depressed into the alveoli, and the bone at the same time may be broken. Such a case came under my care in May, 1882, in the person of a porter, æt. 17, who in a fall off a steamer struck his chin against the edge of the quay. As a result he was rendered insensible for a brief period, and was brought to Guy's with a wound beneath the chin; there was also loosening of the left canine tooth, with a fracture of its alveolus; there was besides most complete depression of the two right lower bicuspid and two molar teeth, their crops being on a level with the necks of the other teeth; and vertical splitting of one of the bicuspids and two of the molars of the left upper jaw also existed. There was likewise bleeding from the left ear, which lasted twenty-four hours, and later on paralysis of the facial nerve, suggestive of a fracture of the base of the skull. The teeth were raised by Mr. Moon, but they never became firm. Otherwise the man quite recovered.

Fractures of the neck of the jaw.

Fractures of the neck of the jaw are always the result of direct violence, and are not very readily made out. Pain aggravated by any attempt to move the jaw is a constant symptom, and so also is crepitus perceivable by the patient. "The condyle," says Heath, "is drawn inwards and forwards by the pterygoideus externus, as can be ascertained by passing the finger into the mouth, and the jawbone is apt to become slightly displaced, so that the chin is turned towards the affected side, and not from it, as in dislocation." I have had under my care a man, æt. 35, with a fracture of both sides of the jaw, just below the condyles, and with fracture of the symphysis, produced by a severe blow upon the jaw below the chin; from the displacement that followed the house surgeon thought it was a case of double dislocation, but on attempting to reduce it, it "went in" without the characteristic snap of dislocation. Ostitis and necrosis of the whole bone below the condyles followed the accident, and a new jaw formed; the man recovering with good movement of the bone.

Fracture of the coronoid process is very rare; and Sanson says that such a fracture never unites.

Treatment of fractures of lower jaw.

TREATMENT.—When the bones can be brought into apposition, the treatment may be described as simple; and where difficulties are met with in reducing the fracture, the treatment is most difficult and un-

certain. In an ordinary case of fracture of the jaw, where no or very little displacement exists, the common four-tailed bandage, a yard long, with a slit in the chin piece of about four inches, made and applied as illustrated in Fig. 230, is useful for *temporary* purposes, but for *permanent* treatment, in the few cases in which no displacement exists, it is well to mould on a splint of gutta percha, made

Temporary splint.

FIG. 230.



FIG. 231.



Bandage and splint for fracture of lower jaw.

according to the shape given above (B), and applied as seen in Fig. 231, A, or, what is far better, adjust a four-tailed bandage made of five or six layers of muslin dipped in fresh plaster of Paris, and moulded to the chin, the bandage being held in position whilst the plaster sets. When healthy teeth are present at the line of fracture they may be fastened together with wire, after the method of Hammond's splint (Fig. 235).

Permanent splint

When difficulties are felt in the adjustment, as in double fracture, where the chin is much drawn down, a good pad may be firmly tied under the chin, or a block of wood adjusted. But in these cases the Surgeon's ingenuity is often taxed to the utmost to meet the wants of the individual case.

FIG. 232.



Thomas's mode of adjusting fractures of the lower jaw with wire and key.

Some Surgeons have suggested that the bones should be fastened together by sutures when all other means fail, and Mr. Hugh Owen Thomas, of Liverpool, has published cases to illustrate the practice. He applies the wire ligature after the fashion illustrated in Fig. 232, using a 1-24th inch silver wire, and fixing it with a key (Fig. 232). ('Lancet,' 1867, and pamphlet, 1875.) In the case of comminuted fracture already alluded to, two or three wire sutures were applied with the best results. Others

On use of sutures.

advise the use of wedges of cork, so adjusted between the teeth as to maintain the jaw in its right line. Hamilton speaks highly of gutta percha moulded to the teeth and gums within the mouth, and Tomes has invented a silver cap to fit the teeth for some distance on each side of the fracture. Barrett carries out the same idea in vulcanite. Berkeley Hill's modification of Lonsdale's apparatus is serviceable, and Moon's splint, as made for him by Millikin, is excellent. It has the advantage of all the other interdental splints already enumerated, is readily adapted to a jaw of any size, and, being introduced separately, is easily applied, and can be as readily removed when desired, without shifting the cap, which fits the teeth on either side of the fracture. Moon's splint, therefore, seems to be the best interdental one we possess, and it should be used when simpler forms are inapplicable (Fig. 233). Mr. Moon tells me that Gunning's interdental splint is one of the most valuable for some fractures of the upper jaw, and also for fracture of the lower jaw where the teeth will not admit the use of Hammond's.

Moon's splint.

FIG. 233.



Moon's interdental splint made in two halves, BB, with horizontal rods to keep cap, Fig. 233A, in position.

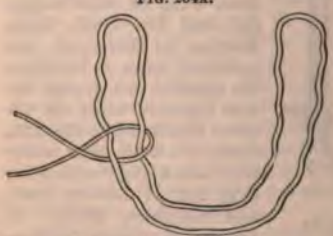
FIG. 233A.



Metal cap fitted over fractured jaw. Represented as wired on for a time, after the withdrawal of external splint.

Among these simpler forms I must class "Hammond's," which I had brought under my notice in 1874 by Mr. Moon. It is a very simple and valuable splint for the general treatment of fractures of the jaw, and has answered admirably in the many cases to which I have had it applied.

FIG. 234A.



Hammond's wire splint for fracture of the jaw.

FIG. 234B.



Hammond's wire splint applied to fractured jaw.

The following description of the apparatus and its application is given in Mr. Hammond's own words: Hammond's splint.

"I first place the patient in as convenient a position as circumstances will permit, then direct him to rinse the mouth with alcohol and water largely diluted, which not only cleanses the mouth, but removes the fœtor of the breath. I next bring (temporarily) the broken ends into approximation by passing a silk thread between and round the two teeth on each side of the fracture, and then secure by tying in front. Then with a suitable tray and very soft wax I take an impression of the teeth, to which, after its having been cast in plaster of Paris, I adjust a frame of iron wire (Fig. 234A), which can be done with a pair of small curved pliers. When all is ready I slip the frame over the teeth in the mouth (Fig. 234B), and while it is held in position by an assistant proceed to tie by passing small lengths of thin iron binding wire after the manner shown in Fig. 234B, twisting them in front until each ligature is nearly tight, turning the ends on one side until they are secured. Next, with the aid of an assistant, I twist the wires quite tight, working alternately each side of the mouth, so as to exert an equal pressure, and thus bring the bone into a natural position, also taking care not to overtwist or break them. I then cut off the ends and turn them in between the teeth. Now the jaw will be found comparatively firm, so solid, indeed, that the patient can bite steadily on it without pain. All that now remains to be done is to secure the jaw perfect rest by the four-tailed bandage." ('Monthly Review of Dental Surgery,' May, 1873.)

It is not absolutely necessary in all cases to take a cast of the broken jaw, although it is so in some, for the Surgeon may mould a frame of iron wire of the thickness that will pass between the necks of the teeth as far as possible on each side of the fracture, and fix the ends by passing them through a small tube one quarter of an inch long, and bending them backwards on the tube. This method is far preferable to any twisting of the ends. It has been taught at Guy's for some time by Mr. Moon. Mode of fastening ends of wire.

This frame should be worn for six weeks.

DENTAL SURGERY.

By Mr. Henry Moon.

General Remarks on Dental Surgery.

Dental Surgery, in its manipulative details, must necessarily, for the most part, be left to those who make its practice a speciality, but some acquaintance with affections of the teeth, and with the principles on which they are treated, is required by every one who is engaged in the practice of medicine or surgery; for without such knowledge he will be unable to advise his patients on the preservation of their teeth (a subject of importance as regards their general health), or save them from the sometimes serious local complications which may attend tooth disease. Nor will he be able to diagnose the true nature of certain tumours and cysts of the jaws, or to attach the proper im-

portance to the teeth as the possible cause of neuralgia of the head and face, and of more remote nervous affections.

In the following pages only a sketch of this branch of surgery is aimed at, and the reader is referred for details to the excellent "Dental Surgery" by the Messrs. Tomes, and to the interesting pages of Mr. Salter's work, 'Dental Pathology and Surgery."

The various parts of our subject may, with advantage, be discussed in two main divisions. In the first section will be considered the defects in structure and abnormalities in form which may arise during a tooth's development, together with irregularities in its placement. In the second section will be considered the diseased conditions to which a fully formed tooth is liable, after it has assumed its destined position in the mouth.

The effect which disease or malposition of a tooth may have on the structures immediately around it, and on the general health, will also be noted.

That a clear idea of these subjects may be obtained, some points in a tooth's development, structure, and connection with surrounding parts must be borne in mind.

Description of a Tooth—its Development and Connections.

The relation of the several tooth structures to each other.

A perfected human tooth (*see* accompanying illustration, Fig. 235) may be described as consisting of an unyielding case of dentine or ivory, enclosing a highly sensitive vascular pulp; the portion of this case that forms the crown of the tooth is protected by a covering of an extremely hard substance, "enamel," which, becoming lessened in thickness as it extends down the sides of the crown, finally terminates at the neck of the tooth; the portion of the case that forms the root or roots is covered by "crusta petrosa," or tooth bone, and is implanted in the alveolar portion of the jaw; the crusta petrosa is covered externally by a sensitive and vascular membrane, "the alveolo-dental membrane," or "periodontum;" this membrane invests the root of the tooth and lines the bony socket, and is besides intimately connected with the dentinal pulp at the apex of the root, and with the gum also where the latter structure encircles the neck of the tooth.

FIG. 235.



Represents a vertical section through a lower molar tooth, showing its different component structures, and its connection with parts around.

Vascular and nerve supply.

Through the foramen at the end of the root blood-vessels and nerves pass for the supply of the dentinal pulp, while other nerves derived from the same source (viz. the second division of the fifth in the case of the upper, and the third division in the case of the lower teeth), are distributed to the alveolo-dental membrane. The teeth are implanted

Implantation.

in the alveolar process of the jaw, which is developed with them and is reabsorbed when they are lost.

Development. Development.—The twenty developing temporary teeth, enclosed in their respective sacs, are contained in the jaw at the time of birth, as are also germs of the permanent molars, and those of the anterior permanent teeth; these latter receding from their position near the surface of the gums and becoming encapsuled, gradually pass down in the rear of the temporary teeth and remain embedded in the jaw, developing at leisure within their bony crypts until wanted to replace their more fragile predecessors. (*See* Fig. 240.)

Shedding of temporary, cutting of permanent teeth. The following is the normal process attending the eruption of one of the anterior permanent teeth. The roots of the antecedent temporary tooth having been absorbed, its crown is shed, and the tooth, released by the absorption of superjacent bone, gradually uprises from the gum—the protrusion of its crown taking place simultaneously with the continued elongation and development of its root.

FIG. 236.



Diagram showing the structures involved in dentigerous cyst and odontome formation.

Diagram of developing lower molar tooth.

A. Dentinal pulp becoming centripetally encased by dentine.
B. Space occupied by enamel organ between centrifugally forming enamel and tooth sac. In this space fluid collects in the formation of a dentigerous cyst.
C.C. The base of dentinal pulp which remains attached and developing until the tooth is completed. By abnormal outgrowth at this point a radicular odontome would be formed.

Development. The development of a permanent tooth thus occupies many years. Take, for examples, the first permanent molar and central incisor, the teeth which are the first developed of the permanent set. Their pulps commence to take form during fœtal life, their calcification commences by birth or in the first months of infancy. Their eruption takes place from the sixth to the eight year, and their root canals with their terminal foramina are not reduced to their ultimate dimensions for two or more years later.

The three hard structures which enter into the composition of a tooth have distinct sources of origin. (*Vide* Diagram, No. 236.)

Enamel dentine and crusta petrosa—their distinct sources of origin. **The enamel** developed from the "enamel organ" of epithelial origin (which occupies the space B in the accompanying diagram) is formed *centrifugally* on the coronal dentine, and through the obliteration of its formative organ, becomes on the eruption of the tooth incapable of further growth or nutritional change.

The dentine is developed from the "dentinal pulp" of vascular connective tissue (*vide* Diagram 236, A) by the immediate agency of a superficial layer of cells called odontoblasts.

The dentinal pulp or bulb, arising from the bottom of the tooth sac, and projecting into its interior, grows up beneath the enamel organ and

progressively takes the destined form and dimensions of the dentine just prior to the formation of that structure; thus, the free end of the bulb, having taken the form of the cutting edge or masticatory surface of the future tooth, becomes capped by dentine, which forms on it from without inwards; and this crown cap being formed, the remainder of the tooth is developed by the gradual growth of the pulp at its attached surface or base (*see* Diagram 236, c, c) and its subsequent encasement by dentine. In the fully developed tooth the pulp comes to occupy a comparatively constricted central chamber, corresponding in form pretty accurately to the external contour of the tooth, and this chamber may be yet further diminished in size by a renewal of the centripetal growth of dentine.

Tooth pulp.

Dentine, remaining as it does in connection with its formative organ through the medium of the tubuli of which it is mainly built up, is capable of a certain amount of increased solidification, even at its periphery, and under certain conditions is endowed with most acute sensitiveness.

Connection of periphery of dentine with pulp.

The crusta petrosa is formed on the gradually elongating root through the agency of the dental sac or capsule which surrounds the forming tooth crown, and ultimately comes to invest the root in the form of the fibro-vascular, "alveolo-dental membrane."[1]

The alveolar portion of the jaw grows up with and is moulded around the developing teeth, and upon the eruption of their crowns, affords the teeth firm implantation, by closely surrounding their roots.

Having thus far traced a tooth's development, we now pass to the consideration of the effects which follow departures from this normal process.

Odontomes.

"Odontomes."

Tumours which result from the abnormal and excessive development of the dental structures at any time during the tooth's formation have been grouped together by M. Broca under the name of Odontomes,[2] and classified by him as follows:

Varieties.

I. **Odontomes Embryoplastiques.**—Those which arise before the dental pulp has developed odontoblasts, and before the enamel organ has acquired special enamel-forming cells.

II. **Odontomes Odontoplastiques.**—Those which arise after the special dentine and enamel-forming cells have been developed, but prior to the formation of the coronal cap of dentine.

III. **Odontomes Coronaires.**—Those which arise while the crown is forming.

IV. **Odontomes Radiculaires.**—Those which arise during the formation of the root.

These four designations, pointing respectively to the periods in the tooth's development at which the hypergenesis of the pulp has arisen,

[1] From the dental sac is also probably derived the membrane known as the "enamel dentis," or "Nasmyth's membrane," which in an unworn tooth is found continuous over the crown, and is regarded by C. Tomes as an undeveloped cemental layer.

[2] Exostosis of the root and "dentine excrescence" in the pulp chamber are called by Mr. Salter "secondary odontomes," and naturally come under that designation, as might also the outgrowth of the pulp which sometimes follows the exposure of that structure; but as these are affections of the fully developed tooth, they will be considered in the second division of our subject.

also indicate to a certain degree the structural formation of a tumour formed at either period; but in adopting these terms it must be understood that, in one sense, the embryoplastic and odontoplastic conditions are present consecutively during the whole period of dentification, and also that if the odontoblast layer of cells is destroyed at any point, true dentine will not there be formed, although the pulp may undergo calcification, resulting in a kind of osseous structure.

Embryoplastic Odontomes.—Under this name M. Broca ranges encysted fibrous and fibro-plastic tumours of the jaw. As the dental germ at the time of their origin contains no special dentine and enamel-forming cells, distinctive dental structures would of necessity be absent from these growths, and such absence must of course leave their dental origin in doubt.

Cases which render probable M. Broca's views on the dental origin of many jaw tumours.

In one instance (mentioned by Tomes) M. Robin met with a tumour in the lower jaw of a child, æt. 2½ years; this tumour, apparently fibrous, was studded with papillæ, on which distinct dentine and enamel were found. Now, whatever doubt may arise as to the origin of the before-mentioned tumours, there can be no doubt as to the dental origin of this one, and it is probable that in it a longer existence would have been accompanied by further dentification. In another odontome, which occupied half of the lower jaw of a girl, æt. 2 years and 9 months, M. Broca found the formation of dentine proceeding at numerous points, and the fusion of these secondary bulbs, coated as they were with enamel organ, would result in bringing about the structural conditions found in an odontoplastic odontome.

Odontoplastic odontomes. Structure.

Odontoplastic Odontomes, in outward form, may bear not the slightest resemblance to a tooth.

Structurally they consist of a more or less confused mass of dentine, enamel, and osseous structure; the dentine occurring in tracts, between which the enamel has dipped down. Enamel is also found capping nodular projections which occur on the surface.

The bulbs of one or more teeth, normal and supernumerary, may enter into their formation.

The case met with by Dr. Forget, and reported by him, may be cited as an example. A man, æt. 20, presented himself with disease of the lower jaw, from which he had suffered since he was five years old. On looking into the mouth a hard smooth tumour was seen occupying nearly the whole of the left side of the lower jaw. None of the teeth beyond the first bicuspid were present. On removal (by section of the containing bone), this tumour proved to be a hard, oval, tuberculated mass, the size of an egg, chiefly composed

FIG. 237.



Represents, on a much reduced scale, the half of the jaw removed in this case. The dots across the ascending ramus mark the line of its section.

Dentigerous cyst of odontoplastic period.

calcified mass, if its formation was disturbed in the earliest odontoplastic period. This fact was well exemplified by the case of a girl aged 13, who was at Guy's under the care of Mr. Cooper Forster (see Fig. 238). Here two small, irregular masses of dentine and enamel, the representatives of an absent canine and lateral incisor, were contained in two distinct cysts, which caused great protrusion of the anterior wall of the superior maxilla. The enclosed tooth may be attached firmly to the cyst wall, or may be found free within the cyst.

FIG. 238



Case of dentigerous cyst not involving antrum.

Antral involvement.

A dentigerous cyst, forming in the upper jaw, may expand into and cause distension of the antrum. Professor Baum met with a case of immense dilatation of both antra, one containing a molar, the other a canine.

In some cases the tooth-crown only, or the crown and part of the root, have been formed prior to the expansion of the capsule by serum, and these may be said to belong to the coronary and radicular periods. In other cases, again, the cyst develops around fully-formed impacted teeth, which may be found inverted. In one instance, mentioned by Tomes, no less than twenty-eight separate and adherent denticles (or small supernumerary teeth) were found in a cyst of the upper jaw, and are probably to be looked upon as the ununited constituent parts of teeth that were missing.

Early origin.

Gradual development.

Although both odontomes and dentigerous cysts have their origin in early life, years may elapse before the irritation caused by the presence of the odontome, or the increasing disfigurement and pain resulting from the enlargement of the dentigerous cyst, may lead a patient to seek surgical aid.

Cysts developed on the root of erupted and fully formed teeth are not classed here as *dentigerous*, as they form only an appendage to the tooth. They will be referred to among the diseases of the teeth, but it may be here remarked that they sometimes attain to a large size and may, like dentigerous cysts, expand into the antrum, and also that their contents under inflammation may become purulent.

Supplemental teeth.

Supplemental teeth (*i. e.* extra teeth exactly corresponding to a neighbouring normal tooth) are occasionally developed in both temporary and permanent sets, usually in the front of the mouth. If they cause crowding or are placed before or behind their doubles, they should be extracted.

Supernumerary teeth (*i. e.* teeth differing in form from any of the normal series) are not infrequently found in the upper incisive region and occasionally in other parts of the mouth. A pair of teeth somewhat resembling incisors, but of greater antero-posterior depth, are occasionally developed behind the permanent upper front teeth and others more resembling small molars or bicuspids are also occasionally met with, but by far the commonest form that the supernu-

of supernumerary teeth present is that of a simple cone, or of a cone truncated and pitted on its summit, and these teeth have a characteristic straight terminal line to the enamel at their necks; they are, in fact, the most elementary form of tooth formation. (See Fig. 239.)

Fig. 239.



Denticle, or most elementary tooth formation.

Treatment.

As a general rule, supernumerary teeth are to be extracted and will always be found to have a single root, which may, however, be contorted and expanded.

Malformed Teeth.—Abnormalities in the form of teeth may result from the dwarfing or excessive development of the different parts or lobes, of which they are architecturally built up, and also from a defective formation of their enamel. These abnormalities may be of great value in the diagnosis of constitutional peculiarities and in throwing light on the condition of health present during a patient's early years.

Dental malformations.

Syphilitic Teeth.—Mr. Jonathan Hutchinson in 1860 first pointed out the association between congenital syphilis and a given misshapement of the permanent incisor teeth, and this fact may be considered fully proven. In 1875 Mr. Hutchinson drew attention at the Pathological Society to his belief that defects in enamel were in many cases due to the administration of mercury in infancy. The investigation of a large number of cases has convinced the present writer of the truth of this belief, and, in fact, when he first gave his attention to the subject in 1868, it was apparent to him that the illustrations of syphilitic teeth given in several works were misleading, and that the malformation they portrayed was not that one distinctive of syphilis, but, if at all due to that cause, was one that had been obscured by some complication.

Certain popular teething powders, containing calomel together with an opiate, appear to be the commonest form in which mercury acting injuriously on the enamel, has been administered.

The distinctive change of shape in the syphilitic tooth is essentially due to a deformed development of the dental pulp prior to its calcification; while rocky or honeycombed enamel is a result and permanent record of depressed or interrupted nutrition of the forming enamel at a particular period, brought about by the action of mercury and probably also by illnesses which lower the system generally or disturb the circulation locally.

The key to the right understanding of these and other mal-developments is to be found in an accurate knowledge of the normal forms of the teeth and in the recognition of the fact that they are *architecturally* though not structurally built up of simpler forms, which are liable to an individual alteration under certain pathological conditions. The distinctive features given to teeth by syphilis and by mercury are apt to be obscured by the action of both in the same case. As through this and other causes, vague notions on this subject are still prevalent, typical forms of normal, syphilitic, mercurial, and what may be regarded as syphilitic-mercurial teeth are on the following page presented at one view, together with a verbal description of their differences.

Fig. 240.

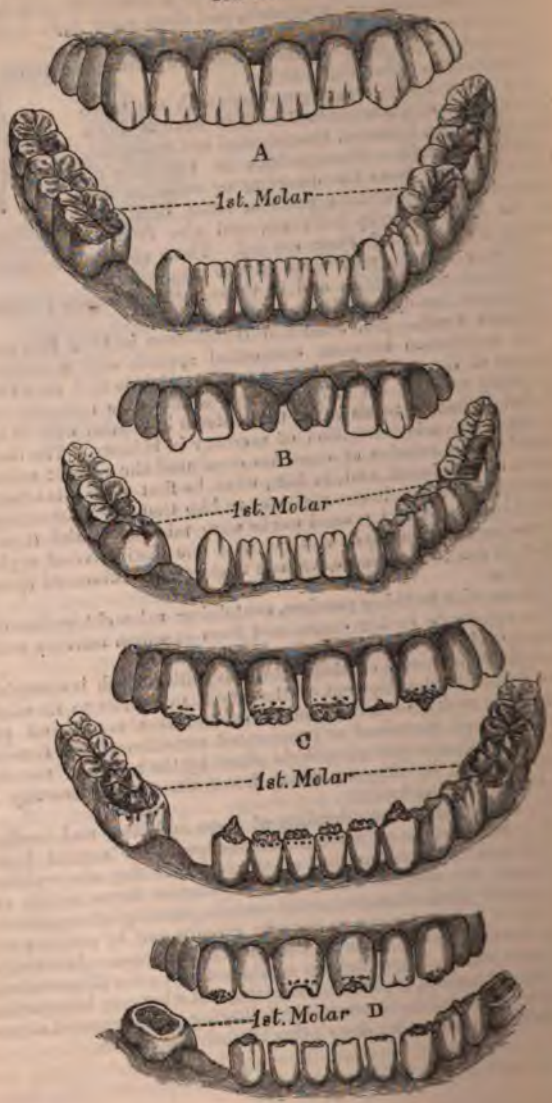


FIG. 240, A. B. C. D.—Represents four typical sets of teeth. The bicuspids, which in neither case suffer alteration are withdrawn on the right side to bring the 1st molars better into view.

A. *Normal teeth.*—The labial surfaces of the incisors are seen built up of three equal columns and present a greater width at their cutting edges than at their necks. The upper central incisors are longer than the laterals. The 1st lower molars are large and angular teeth and have five well-marked cusps--sharp pointed through the greater prominence of a central tubercle. The upper first molars are also large teeth, with well marked cusps. The cutting edges of the incisors quickly lose their three prominences by wear.

B. *Syphilitic teeth.*—In the upper central incisors the central column is *dwarfed* and the side columns incline toward each other, causing the cutting edge of the tooth to be less in breadth than its neck. They are often much less prominent than the teeth on each side of them, through their diminished size and also from a want of vertical depth in the portion of alveolar process in which they are implanted. Commonly these teeth have a quarter turn which brings their distal sides to face slightly to the front. The lower incisors have their cutting edges rounded off and therefore not touching their neighbours. The 1st molars are reduced in size and *dome* shaped, through the dwarfing of the central tubercle of each cusp. Syphilitic teeth may have a perfect covering of enamel and will not then be discoloured.

C. *Teeth with defective enamel.*—Aliases, "stomatitic," "honeycombed," "rocky," "*mercurial.*" Are malformed not through a changed shape of dental pulp, but from failure of enamel to form an even centrifugal encasement over them. If the deficiency of enamel is superficial the colour of the tooth may be unaltered, but if the pittings are deeper they usually appear as black points, or the more or less discoloured dentine is revealed and imparts to the tooth a dirty "size coloured" appearance. The bicuspids, second molars and wisdom teeth usually escape through their later development. The age at which the depressed nutrition occurred and its duration are accurately recorded on the teeth.

D. *Syphilitic-mercurial teeth.*—As regards syphilis the contour of these teeth would be the point of chief diagnostic value. In the left central upper incisor a small central tubercle of dentine is seen denuded of enamel, which looks as if it had been gouged out from above downwards: in the right central the exposed dentine has broken away, leaving a *crescentic notch.* In the 1st molar a depressed area is seen on the masticating surface, circumscribed by a ridge of enamel, the denuded and ill-formed points of dentine representing the cusps having been lost.

Degrees of syphilitic malformation.

Syphilitic malformation of teeth ranges from an excessive dwarfing, in the worst cases leaving only a shapeless peg to represent the incisor, to the merest indication of the typical form. It is not present at all in some cases of congenital syphilis and one child in a family even may escape it, while the elder and younger children have it.

Various forms of enamel defects.

In honeycombed teeth an irregular and insufficient development of enamel, produces horizontal groovings or pittings of its surface and most often affects the first formed points of the cusps, sometimes leaving them entirely denuded as shewn in the figure given; but when the agency which arrests the enamel formation is brought to bear later, the cutting edges of the incisors and the tips of the cusps of the molars will have a perfect covering of enamel and the defective lines will be below them. Sometimes, presumably when the cause has been gently exerted for a long time, slight horizontally arranged pittings cover the whole crown.

The irregularly formed enamel may be structurally defective, as shown by its discoloration, and this may conduce to decay, as does also the pitting of the enamel if it extends through to the dentine. In other cases the diminished size of these teeth, which prevents their being crowded and exposes their sides to healthful friction, renders them less obnoxious to decay than might have been expected.

Instances of pointed teeth, not indicative of syphilis.

Some children of different families seen by me, present, together with great peculiarities of their eyes and a general weakness in the development of their dermal structures, the following peculiarities in their teeth:—The middle lobes are sharp, recurved and excessively long, while the lateral lobes are dwarfed. In these cases, however, the resulting pointed form can be readily distinguished from the truncated screw-driver like form indicative of congenital syphilis. See Fig. 240*a*.

Fig. 240*a*.



Pointed teeth, well covered with enamel—not syphilitic.

Imperfections in Structural Development.

Structural defect conducing to decay. Malnutrition.

At the present day the early decay and loss of teeth is very common, and is probably in part due to an insufficient supply of food containing the elements which go to build up the osseous structures, malnutrition in early life, from whatever cause, leaving inevitably its mark on the exteriors of the teeth, which, once ill formed, have no power of recuperation.

In infancy and childhood plenty of good milk and the use of "*whole* flour meal" are to be recommended; it is to be borne in mind that until a child begins to take animal food, the above are the sources of supply of lime salts. The diet of the pregnant mother may also with advantage receive attention.

Structural defects in enamel development.

Perfect enamel contains upwards of 95 per cent. of earthy matter, and consists of rods united together without intervening matrix, and placed at right angles to the surface of the dentine. Enamel when well formed, is semi-transparent, but when defective from a want of homogeneousness in its structure, presents an opaque, white, chalky appearance, and is then easily disintegrated. At the bottom of the natural sulci of otherwise well-formed teeth, enamel is sometimes deficient in thickness and in soundness, and this favours the ingress of decay. Defective enamel.

Structural defects in dentine formation.

Well-formed dentine is uniformly dense and ivory-like. It is built up of tubuli and intertubular substance, the tubuli serving to convey nutrition from the pulp to the periphery. Dentine is endowed with sensitiveness through the soft tissue, which passes from the pulp to the surface, and renders the dentine immediately beneath the enamel especially sensitive. Dentine.

Through imperfect development a (so-called) granular layer which is found on the surface of dentine in the root may be present on the surface of coronal dentine. The (so-called) globular condition of dentine is another developmental defect. When the enamel covering is lost, imperfect dentine softens rapidly under decay without becoming darkened, and is also apt to be exceedingly sensitive. Imperfections in dentine.

Cutting of the Teeth.

During the eruption of the temporary teeth, if there is disturbance of the general health traceable to dental irritation, and especially if there be the least sign of cerebral disturbance, there should be no hesitation in freely lancing the gum—tumid or tense—which covers the tooth that is presenting. In the case of a front tooth a straight incision should be made on to the *front* of its cutting edge; in the case of the molars a crucial incision should be made from corner to corner. Lancing of gums.

As a rule the permanent teeth erupt very easily, but an incision with a lancet may sometimes with advantage be had recourse to in cases where cerebral disturbance is easily excited, and it is often well to remove bodily the gum from above an erupting wisdom tooth when an antagonist tooth bites upon and irritates it.

Irregularity of Position.

Irregularity of arrangement hardly ever occurs among the temporary teeth, but an undue prominence of the upper incisors, which sometimes is acquired through thumb-sucking and a tendency to underhanging, from the over-development of the lower jaw as compared with the upper, should receive attention, in order that these conditions may not be perpetuated in the second set. The absence of the spacing of the temporary teeth, which should precede their shedding, will point to a likelihood of crowding among the coming permanent teeth, and demand watchfulness. Irregularity. Contracted jaws in the young.

Irregularity of the permanent teeth often results from the want of timely extraction, and even oftener from the untimely extraction of temporary teeth. It therefore behoves the Surgeon who may be called upon to extract teeth from young subjects to acquaint himself with the

time of eruption of the different permanent teeth, and with the points of difference between temporary and permanent teeth.

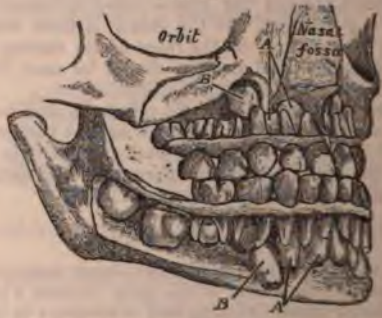
Well-developed adult jaws should consequently be thoroughly studied as a type, and compared with the jaws in childhood. It will be then seen that development has occurred longitudinally backwards for the accommodation of the permanent molars, while the part of the jaws that was occupied by the ten temporary teeth, having undergone additional development on its anterior face, is in the adult occupied by the incisors, canines, and bicuspids. In order that these latter may have room for even arrangement it is important that the anterior permanent molars (the six-year-old teeth) should *not* be allowed to take up a too forward position, which they will do if the temporary molars are prematurely lost from neglected decay. On this account, therefore, the timely stopping of the back temporary molars is a practice to be recommended.

Preventive measures.

The accompanying figure will show how easily irregularities may be brought about, as the retention of the root of a temporary tooth is enough to prevent the permanent tooth from taking up its proper position.

In judging of the amount of space that there will be for the accommodation of the coming teeth, it is to be remembered that the alveolar portion of the jaws grows up with and is moulded around the teeth it supports, and that there is a strong tendency for teeth to assume their proper position (the action of the tongue and lips conducing thereto) while the replacement of the temporary molars by bicuspids increases the space for the front teeth.

FIG. 241.



A. Permanent incisor teeth. B. Permanent canine.

Drawing of jaws of child æt. 6. A and B point to permanent incisors and canine. The bicuspids are seen embraced by the roots of the temporary molars. The permanent molars, with the exception of the wisdom, are present.

A very common form of irregularity results in otherwise well developed jaws from the permanent upper incisors being erupted to the rear of their unshed predecessors. In such a case the prompt removal of the temporary tooth is demanded, for if, on the further elongation of the upper permanent incisor, the edge once passes behind the incisor of

the lower jaw, at such closure of the mouth the evil is increased, and can then only be corrected by the use of a regulating plate. On the same score, lower incisors may sometimes be kept in the rear of the temporary teeth in order that they may be ready to wedge forward the upper incisors, and thus *secure the overlapping of the upper front teeth* which allows of their true incisive action while it spares them undue wearing away.

Upper front teeth should overlap unders.

In spite of the above precautionary measures at the time of the second dentition, cases of irregularity will occur from malformation and insufficient development of the jaws. Some of the slighter of these irregularities are amenable to surgical treatment—that is, a timely extraction will allow nature to set all straight—but if a tooth is taken out on one side of the mouth to relieve overcrowding, the preservation of symmetry will often demand the extraction of another on the opposite side. The patient's profile and the relative prominence of the upper and lower dental arches have to be considered in deciding whether permanent teeth should be extracted for regulating purposes, while the soundness of teeth, the direction taken by their roots, the firmness of their implantation, and their comparative durability, are all points to be considered in deciding which tooth should be sacrificed for the benefit of the remainder.

Facts to be considered in extracting for irregularity.

Sometimes the first permanent molar may with advantage be taken out when the tendency to overcrowding is decided. If this tooth, which is particularly liable to decay, is past hope of permanent preservation by stopping, its extraction in time allows the second molar to come forward and partly occupy its site, and the wisdom tooth to come well into place, while it also enables the front teeth to spread, and thus escape undue lateral pressure and consequent decay.

On the extraction of the six-year-old molar.

On the other hand, there is the strongest reason for preserving this tooth when the upper incisors are so prominent as to require drawing back, as it often affords the only satisfactory point from which traction can be exercised, and a bicuspid in such case should by preference be sacrificed. Another valid objection to the extraction of the first permanent molar, occurs when the withdrawal of the prop which this tooth affords at the back of the mouth would cause the lower incisors to bite up unduly on to the necks of the uppers and drive them forward.

Here it may be remarked that in all attempts to improve the regularity of the teeth the relative positions of the antagonist teeth in the other jaw must be taken into account.

The "bite" to be considered.

So far only those cases have been considered that are capable of being benefited by timely extraction, but many cases require for their treatment the use of mechanical appliances. Among these appliances a lever for expanding the arch of the upper teeth (while it presses back the lower) and elastic bands are of great use; while in more advanced cases a regulating plate must be worn, the principle of its action being that it affords a fixed point from which continuous pressure or traction is kept up on the teeth to be moved.

Regulating appliances.

The movement of teeth by mechanical means should be gradual, or absorption of bone will result without a compensatory development, and the teeth will be loosened. Twisted teeth can be turned on their axes. Instanding upper front teeth can be trained out, and will be *retained in their new position* as soon as they are brought to overlap

Rabbit-mouth.

the lower teeth; prominent and projecting upper teeth can be gradually trained in, but will be required to be kept in place for some time by mechanical means to prevent their reverting to their original position. The lower lip passing behind prominent upper incisors increases the deformity which is usually associated with a contracted arch.

In regulating teeth much greater difficulty has to be overcome where contraction or malformation of the jaw causes the irregularity, than in those cases where there is simple misdirection of the teeth themselves.

Underhanging.

In some cases complete underhanging of the jaw is present, *i. e.* the upper teeth, back as well as front, are set within the arch of the lower teeth; this condition does not admit of much remedy when once firmly established, but may be prevented to a certain extent by timely extraction of lower teeth together with a training out of the upper. The earlier that irregularities receive attention the better, in order that the misplacement may not be increased, and also because the moving of teeth can only be safely effected in the young.

Insufficient room for canine and wisdom teeth.

Canine and wisdom teeth, owing to the lateness of their eruption and the position they occupy during development, are peculiarly liable to be shut out from the dental arch. The canine being a durable tooth, should in many cases have room made for it by the extraction of one of the teeth that have closed in upon its site. The cutting of wisdom teeth is frequently attended with much trouble, and it may be remembered in the case of young subjects with small maxillæ, whose first or second molars are much decayed, that the timely extraction of either of these teeth may allow the wisdom tooth (if developed) to erupt easily and occupy a useful position. In the upper jaw, if the wisdom is forced to take an outward direction, and so cause irritation of the cheek, it should be extracted. In the lower jaw, where there is insufficient room for it between the second molar and the ascending ramus, its efforts to erupt often produce nerve irritation, chronic spasm of the masseter, the formation of pus between the crown of the tooth and the superjacent gum; it may also cause absorption of the root of the second molar and lay bare its pulp.

Impaction of lower wisdom.

In all cases where the impaction of a lower wisdom tooth is a source of irritation, the impaction should be at once got rid of either by the extraction of the wisdom tooth or of the tooth in front.

Treatment.

The operation required, as well as the serious results which may attend purulent inflammation about an impacted wisdom tooth, will receive notice later.

Misplacement.

Teeth are sometimes erupted in strange positions; thus, Salter records a case of inversion and eruption of lateral incisors in the nares, and Tomes figures the case of a molar erupted in the median line of the palate, and another case in which the crown of a molar pierced the cheek at the angle of the jaw. In another case, figured by Tomes, the crown of a molar presented at the sigmoid notch, but remained impacted.

Impaction of teeth.

Impaction, or retention of a tooth within the maxilliary bone often occurs without any ill results, but occasionally it is productive of severe mischief. Thus, in a case which occurred in the practice of Mr. Cartwright, sen. (and which is reported at length by Mr. Salter), it was productive of severe neuralgia. In this case the presence of

an impacted upper canine, which caused a prominence on the palate, gave rise for eight years to constantly recurring, most severe neuralgic pain, confined to a circumscribed spot on the left side of the vertex of the head. In other cases it may give rise to cystic enlargement or abscess, the latter perhaps late in life, from the buried tooth becoming more superficial through absorption of the containing bone. The palate may be involved if a tooth is impacted within the palatine process of the superior maxilla, or an abscess may be formed below the tongue from impacted lower teeth. Complication resulting from impaction.

The following case was reported by Mr. McCoy in the 'Lancet,' 1871:—A boy, æt. 14, had a tumour of the antrum the size of an apricot, due to an impacted canine, the crown of which projected into the antrum, while the root was impacted in a socket in the nasal process; the antral cavity contained a little glairy fluid, but was chiefly filled by a gelatinous substance—apparently thickened mucous membrane.

Absence of Teeth.—A few cases are recorded of edentulous jaws. Wisdom and upper lateral incisors, the teeth most liable to variations in size and shape, are also the most liable to suppression. Occasionally other permanent teeth, notably lower second bicuspids, fail to make their appearance, in which case it may be right to leave their predecessors undisturbed, if they show no signs of loosening; temporary molars may in such cases serve for many years. Non-development of teeth.

The tendency of particular teeth to take irregular positions, and the liability of others not to be developed, are facts that have to be borne in mind in connection with the probable dental origin of tumours and cysts of the jaws. Odontomes and dentigerous cysts.

Before passing to the second division of our subject it may be useful to enumerate the morbid conditions which may be simulated by the tumours, cysts, &c., which originate from an unerupted tooth in the ways described in previous pages. The affection they may simulate.

Odontomes may give rise to appearances such as may be presented by benign or malignant tumours, whether arising spontaneously or due to the impaction of a foreign body, such as root of tooth, splinter of bone, or a bullet.

Dentigerous cysts, when slowly forming and before they have thinned the enclosing bone to an extent which would allow of the characteristic sign of *craquement* on pressure, may be difficult to diagnose from solid tumours.

A dentigerous cyst may also produce the same symptoms as a cyst formed on the root of an erupted and diseased tooth, and when through inflammation its fluid contents become purulent, it may, in like manner, resemble an alveolar abscess (*i. e.* an abscess formed around the root of a diseased tooth), and, like it, will be apt to give rise to a fistulous opening.

Suppuration in the antrum, or Empyema, arises probably in two distinct ways. In the one case it is due to inflammation of the lining membrane of the cavity, which, being continuous with the mucous membrane of the nose, allows of the escape of the contained purulent fluid into the middle meatus by the natural orifice. In the other case the pus is contained in a sac which has expanded into the antral cavity, carrying the lining membrane before it, and then the pus does not find exit by the nasal opening; this latter condition (as pointed out by Otto Empyema of antrum.

Weber) is generally present when the root of a tooth originates the mischief by penetrating the cavity, and when an alveolar abscess extends into it, while cysts formed on a root, and dentigerous cysts expand into the cavity in this manner and may afterwards suppurate.

Diagnosis.

The history of these cases may throw light upon their nature, while a careful examination of the mouth should be made to decide whether the due number of permanent teeth have been erupted, and as to the existence of disease in any tooth in the neighbourhood of the tumour. An exploratory puncture or opening should be made in any case that may have a dental origin, before any serious operation is undertaken for the extirpation of the disease.

Treatment.

For treatment it will here suffice to say that the complete removal of any tooth or dental formation involved is demanded, and that for the remaining treatment the ordinary rules of surgery apply.

Diseases of the Teeth.

Dental pathology.

The largeness of the nerve supply to the dental pulp and periodontal membrane, and the liability to irritation and inflammation to which these confined vascular structures are subject, give an importance to diseases of the teeth which they would not otherwise possess; the pain, direct or reflex, which nearly always attends the involvement by disease of these dental vascular structures, and the serious local lesions which may follow their suppurative inflammation, often cause the mere destruction of the tooth as an organ of mastication to be a matter of secondary importance, although in itself sufficiently regretable. Bearing in mind the description of a tooth given at page 638, it will be understood how the maintenance of a tooth in its usefulness depends on the integrity of its component structures, and how it happens that the pulp and alveolo-dental membrane, which, in a condition of health, are tissues simply subsidiary to the nutrition of the hard structures around them, become—when the tooth is attacked by disease—the parts which have especially to be protected from invasion.

Morbid conditions which cause irritation of dental nerves.

The morbid conditions which may produce irritation of the dental nerves may with advantage be grouped in two divisions.

The first division, including those which cause irritation of the nerves supplied to the pulp with their continuation into the dentine, consists of—

(*a*) Exposure to irritation of sensitive dentine, through loss of enamel resulting from Caries, Erosion, or Fracture.

(*b*) Irritation and chronic or localised inflammation of the pulp when deprived of its protective covering of dentine through the more extended action of the destructive agencies named under (*a*)

(*c*) General inflammation of the pulp, following sooner or later on the previous conditions, and resulting in its sphacelus.

(*d*) Irritation of the pulp through the presence of irregular formations of secondary dentine in the pulp chamber.

The second division, including the morbid conditions that cause irritation of the nerves supplied to the alveolo-dental membrane and to the dental nerves external to the tooth, consists of—

(*a*) Dental Periostitis, *i. e.* inflammation (plastic or suppurative) of the periodontal membrane. This results by far the most commonly from inflammation and sphacelus of the dental pulp; it may be caused

by rheumatism and by syphilis or may be a symptom of salivation. It may be produced by irritation of the periodontum at the neck of the tooth where it meets the gum, and occasionally results from the undue pressure of an opposing or contiguous tooth.

(*b*) Exostosis (*i. e.* hypertrophy of the crusta petrosa), sometimes resulting from, sometimes the cause of irritation and inflammation of the periodontum.

(*c*) A needle-like pointing of the end of the root, and a roughening of its end by absorption.

(*d*) Impaction of permanent teeth in the maxillary bones, and futile attempts to erupt made by such teeth, especially in the case of lower wisdoms.

(*e*) Overcrowding of the teeth.

Odontalgia.

Irritation of the dental nerves may excite pain at the point of irritation, producing toothache, the pain being either confined to the faulty tooth, or being centered in it, and radiating to the adjoining teeth and to the nerves of the same side of the face and head, but not infrequently it gives rise to reflex pain, in which case the tooth at fault often escapes suspicion on account of its freedom from pain. More remote sympathetic nerve affections are also sometimes caused by dental irritation.

Reflex nerve irritation.

A most unequal amount of pain, or nerve disturbance, occurs in different subjects from dental lesions of an apparently similar nature. Such differences must be referred to structural peculiarities of the teeth, and to the conditions of health, and to the diathesis of the patient.

Neuralgia.

A faulty tooth is the real origin of many cases of neuralgia about the head and face, although cold, or depressed vital power, will determine the time of onset.

That remote sympathetic pain may be due to dental irritation, will be easily realised by any one who has felt the distribution of his spinal nerves demonstrated on the scraping of sensitive dentine in his tooth.

Toothache, varieties of.

Toothache (or localised dental pain) varies in character according to the part of the tooth involved; these differences will be apparent as the effects of disease in the several dental structures are considered, but it may be here remarked that a darting pain (which may fade away with an ache) betokens irritation, and probable exposure of the pulp—that intense pain, of a violent, throbbing character, points to general inflammation of the pulp, and may be expected to cease entirely with the destruction of that structure's vitality, and that the pain which attends irritation and inflammation of the periodontal membrane is of a dull or gnawing character; but may assume a throbbing character if an alveolar abscess is formed.

From pulp irritation.

From general inflammation.

From periodontitis.

Hyperæsthesia of pulp

Hyperæsthesia of the pulp may be expected to coexist with the conditions which act on its nerves, and is evidenced by sensitiveness of the tooth to heat and cold. A hot instrument applied in succession to the crowns of suspected teeth may afford valuable evidence on this point, and tapping the teeth may also reveal the over-sensitiveness of any one tooth. Slight periosteal irritation may accompany this condition.

Peri-odontitis.

Dental periostitis, at its onset, is often attended by a sensation of fulness in the tooth, which inclines the patient to press it firmly into its socket; this sensation is succeeded by painful tenderness on pressure of the tooth, which is oftened slightly raised and loosened, while

Symptoms.

the gum, which at first presents a narrow red line around the neck of the tooth, tends to become diffusely red and tender over the root.

In obscure cases of pain, the presence or absence of circumscribed periodontitis, and of irritation due to exostosis, may be diagnosed by pressing the crown of the tooth in different directions, so as to tilt the end of the root against the socket; the biting of something hard with one tooth after another may also be adopted as a means of finding out if irritation of this obscure nature is present in a root.

Reflex Nerve Affections due to Dental Irritation.

The nerves of the second and third divisions of the fifth are more liable than any others to reflex affections due to dental irritation. Next to the several branches of the Trigeminus, the nerves of the Cervical and Brachial plexuses are most often involved.

Neuralgia. **Neuralgia.**—The following are the most common sites for the manifestation of reflex pain.

(*a*) Another tooth to the one in fault, frequently the one that antagonises it in the opposite jaw, and occasionally a tooth in front of the one irritated (thus, an innocent bicuspid may ache when the wisdom tooth is at fault).

Hemicrania. (*b*) The side of the head, with the focus of pain near the parietal eminence, due to irritation of a tooth (generally an upper back one) of the same side; this is the source of many cases of unilateral headache.

(*c*) The eyebrow, with the focus of pain at the supra-orbital notch, and the cheek, with the focus of pain at the infra-orbital notch, the irritation in these cases being located in the upper teeth.

(*d*) From irritation of the back lower teeth there may result earache, and pain extending over the temple, and also pain passing down the neck.

Pain over the upper cervical vertebra appears generally to come on secondarily to the above-mentioned neuralgiæ.

More remote Nervous Affections.

Pain, to quote the words of Mr. Salter, is only one of the phenomena of reflex dental nerve irritation. There may be produced muscular spasm and muscular paralysis, paralysis of some of the nerves of special sense, perverted nutrition. In these pages an enumeration of some of these affections can only be made, and the reader is referred for details of cases to the work on 'Dental Pathology and Surgery,' by the above-named author, and to the second edition of 'Tomes' Dental Surgery.'

List of sympathetic nerve affections due to dental irritation. The following secondary and remote nervous affections may arise from irritation in the teeth, and be curable by the removal of the exciting cause:

Convulsions, &c., resulting from irritation in teething.

Epileptiform seizures. In these cases, when an uneasy sensation is felt in the mouth previous to the attack, the best results may be hoped for from stopping or extraction, as the case may demand.

Delirium from retarded eruption of wisdom teeth.

Firm closure of the mouth through chronic spasm of the masseter muscle is a frequent complication of irritation in or about the lower back teeth.

Wry neck. Pain in the course of the cutaneous branches of the cervical plexus.

Partial paralysis of the arm and hand, with an inability to grasp with the fingers, accompanied by aching pain. (Several such cases have recently been under my observation, a fact which shows their comparative frequency.)

Amaurosis. Strabismus. (Ptosis and deafness are also recorded complications.)

Ulceration in the course of a branch of the fifth nerve.

A case of obstinate leucorrhœa and acute uterine pain cured by the extraction of a tooth was recorded by the late Mr. Sercome.

One case of fatal tetanus is quoted by Mr. Tomes as having followed the operation of pivoting.

Such are some of the reflex pains and remote complications which may arise from dental irritation in a patient of neuralgic diathesis, but apparently similar exciting causes are constantly present without producing any such results.

Dental diseases.

In an apparently sound tooth an irregular formation of dentine in the pulp chamber is sometimes the cause of neuralgic pain, and may be suspected if hyperæsthesia of the pulp exists in a tooth exhibiting no other cause for over-sensitiveness.

Exostosis and occasionally needle-pointing of the fang may also be the cause of neuralgic pain at the root of a sound tooth, and may have their probable presence revealed by the tooth exhibiting tenderness on pressure into the socket, and perhaps later on by other evidences of periosteal irritation. Being otherwise irremediable, extraction is demanded in these not to be foreseen conditions.

Their progressive character.

With the exception of the above comparatively rare cases it will be noticed by referring to the list of morbid dental conditions given at page 654 that all the affections there enumerated may result from the spread of disease from one dental structure to another, and therefore demand treatment for their prevention and limitation. Thus, when the exterior of a tooth is the first part attacked—as it always is in caries and erosion—the aim should be to preserve the pulp from irritation and exposure, and when the pulp is already exposed through the above diseases or by fracture, the aim should be to prevent its inflammation; while if the vitality of the pulp is past saving, means should be taken to prevent the involvement of the periodontum, and finally, if that tissue is involved, extraction of the tooth may be demanded to relieve pain, and to prevent the formation of alveolar abscess with its possible complication of fistulous openings on the face, or the still graver consequences which inflammation external to the tooth may bring about.

Peculiarities in structure of tooth that aid its conservation.

Three facts in the nature of a tooth aid dental surgery in its conservative efforts. The first is, that the dense and evascular character of the enamel and dentine allows a diseased portion of them to be removed, and the remainder to be preserved by friction, or by a filling inserted in the place of the removed portion.

The second favouring fact is the continued presence on the surface of the pulp of the odontoblast layer of cells, ready to form secondary dentine over the pulp, and thus shield it, if they are stimulated to renewed action by irritation of the primary dentine.

And thirdly, the small calibre of the root canal in a perfected tooth, and the minuteness of the aperture that remains at the end of the root

for the passage of the vessels and nerves, cause the pulp to be so comparatively isolated, that, when diseased, it can with safety be destroyed by escharotics and be extirpated before its sphacelus has involved the structures external to the root.

Caries, its great prevalence.

The practical remark may here be made, that up to middle age, probably 90 per cent. of the teeth that are lost owe their destruction to caries, while later in life recedence of the gums and absorption of the alveolus—often prematurely induced by the presence of tartar—lead to the loss of many teeth by depriving them of implantation.

Before reviewing the agencies destructive to the teeth it will be well to consider the nature of secondary dentine and cemental exostosis, which occupy a debatable position between healthy and pathological tooth formations.

Secondary dentine.

Secondary Dentine.—Three different developments come under this name. The *first*, called by Salter "Dentine of repair," has been alluded to already. The loss of dentine externally through abrasion, caries, erosion, or fracture, will oftentimes produce compensatory development internally—at the point where the affected dentinal tubuli abut on the surface of the pulp; this reparative growth prevents pulp exposure when, from attrition, the enamel and a considerable portion of dentine have been worn away from the surface of a tooth, and sometimes it will obliterate the pulp chamber. In cases of decay "dentine of repair" does not often, unaided, prevent exposure of the pulp, but it hinders it, and becomes a valuable auxiliary in its protective treatment (*See* Bicuspid, in D, Fig. 243, p. 663.)

Different kinds of.

Dentine of repair.

Second form.—Cases have been described by Salter and others in which a nodular outgrowth of dentine or osteo-dentine has projected into the pulp-chamber of a sound tooth, and has given rise to severe neuralgia. This development must be regarded as morbid, and has been named by the above author "Dentine excrescence."

"Dentine excrescence."

The *third form*, or secondary dentine, is essentially an affection of the pulp. "Intrinsic calcification" is the name proposed for it by Mr. Salter, who has described its formation as thus occurring:—Isolated masses of osteo-dentine form, at first usually in the axis of the pulp; these masses enlarge and merge into one another, and spread towards the periphery, and may at length occupy the whole of the pulp chamber. This formation may be regarded as sometimes resulting from and as sometimes the cause of pulp irritation.

Intrinsic calcification.

Exostosis.

Exostosis is a term applied to enlargement or outgrowth of the crusta petrosa (*see* Molar, in E, Fig. 243), ranging in amount from a slight general thickening (when it can hardly be regarded as pathological) to an outgrowth which may double the size of the root, and sometimes has fused together the roots of contiguous teeth. The deposition of cementum may alternate with its absorption, and not infrequently it will be found thickened on the upper part of a root where chronically inflamed periosteum exists, while the end of the root will be bare of it, and be bathed in the pus of an alveolar abscess. It often causes a globular enlargement of the end of the root. Sometimes small excrescences of it will form on tooth after tooth, and by giving rise to most severe neuralgia will necessitate their extraction.

Exostosis may arise secondarily to inflammation of the periodontum, and will then be accompanied by extra vascularity and tenderness of adjacent gum, &c. The means for detecting its presence in its early

stages, when arising primarily and causing neuralgia, have been already mentioned; symptoms that will be likely to attend its prolonged presence as a source of irritation are those of periodontal inflammation.

The nature of the agencies that destroy the dense structures of the tooth will now be considered, and inasmuch as the sequence of disease, when once the pulp is exposed, is much the same whether the exposure has occurred through caries, erosion, or fracture, the treatment of progressive dental disease and the various affections of the pulp will be considered and illustrated once for all; and, finally, dental disease external to the root, with its complications, will receive notice.

Caries.

The great prevalence of caries at the present day makes it desirable that its nature and the means for its prevention should be understood. These subjects will therefore be discussed somewhat at length.

Dental Caries or Decay

may be described as the disintegration of the hard structures of the tooth by decalcification. It always commences on the exterior of a tooth, and saps inwards; when the crown is attacked by it, a fault in the enamel is the first step in its course, and may be due to original faulty development, or to mechanical or chemical injury.

Always begins on exterior of tooth.

Fracture may produce the enamel lesion.

A frequent cause of disintegration of the enamel is the attrition exercised by the sides of crowded teeth on each other, and as this sets up interstitial decay a nidus is thereby formed, which serves as a laboratory for the production of chemical destructive agents which act on the adjoining tooth.

Interstitial decay in one tooth causes decay in the next.

Chemical solvents are formed by acids derived from the buccal mucus and food mixed with saliva, which—lodging between the teeth and in natural depressions—undergo decomposition.

It is now also pretty clearly established that micro-organisms, which are constantly found present in carious cavities, play an important part in the disintegrating process.

Overcrowding of the teeth, viscid buccal mucus giving an acid reaction, a vitiated condition of the fluids of the mouth, due to derangement of the digestive organs, the eating of sweetmeats (as carried by some young people to a most injurious extent), conduce to decay, and should therefore be avoided or prevented. The condition of the mouth attendant on fevers accelerates decay.

Prevention of decay.

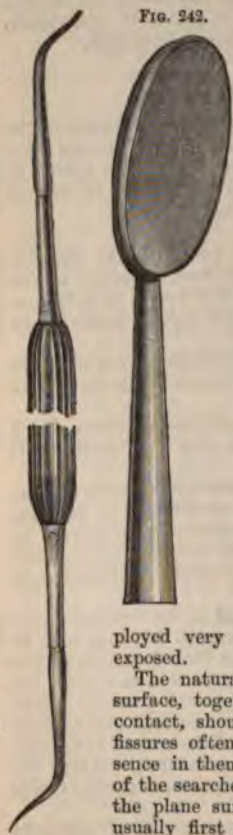
The great *preventive* of decay is friction, that is, the keeping of the surfaces of the teeth swept clean of the food, mucus, &c., that tend to lodge between or about them. With this object their lingual as well as labial and buccal surfaces should be brushed night and morning; the direction of the brushing should be always from the gum, *i. e.* downwards for the upper and upwards for the lower teeth, as this removes food from between them by the natural lines of clearance; the masticating surface of the back teeth should also be brushed. Where the mucus is ropy and clings to the teeth a saponaceous tooth powder should be used.

Rinsing out the mouth after meals is a practice to be generally encouraged, and the use of a weak alkaline mouth wash may with advantage be had recourse to, in order to correct undue acidity of the

oral fluids, and also to neutralise the local effects of strong acid medicine.

Among preventive measures must be classed what may be termed preventive stopping. For example, a small spot of decay is often found near the distal edge (of the masticating surface) of the second temporary molar; if this be not stopped the decayed posterior surface of the tooth will come in contact with the mesial surface of the first permanent molar on its eruption, and decay be started in it; then on the shedding of the temporary molar, its successor, the second bicuspid, will have its distal surface exposed to decay from contact with that already existing in the first molar; and thus from lack of a small stopping in a temporary tooth, two permanent teeth are frequently lost or only saved by elaborate fillings.

FIG. 242.



Insidious character of.

The progress of decay is usually very insidious, a minute and unnoticed fault or fissure of the enamel often leading to extensive decay of the dentine. (See decay depicted on masticating surface of molar in D, Fig. 243.) A warning by pain is by no means always given, but sometimes a twinge or slight ache is experienced when the periphery of the dentine is reached and becomes irritated by saccharine or sapid substances or by thermal changes; if this warning is neglected, often nothing more is felt till an acute twinge shows that the pulp is exposed, or a caving-in of the enamel reveals a large cavity. It thus happens that the detection of decay in its earlier stages can only be insured by frequent inspection of the teeth. Such inspections should begin with the first teeth, and be carried out systematically several times a year if the teeth are to be preserved and much stopping avoided.

Pain a beneficent warning.

Frequent inspection recommended.

For the purpose of examination, a mouth mirror and a pointed instrument are required; the double-pointed searcher here figured (Fig. 242) is particularly useful, its curved ends being adapted to pass between the necks of the teeth; it should be employed very lightly in finding out whether a pulp is exposed.

Natural depressions favour the development of caries.

The natural fissures and all depressions of the tooth's surface, together with the sides of such teeth as are in contact, should be carefully examined. A darkening of fissures often points to decay in their depths, and its presence in them may be considered certain if the fine point of the searcher passes through to the dentine. Enamel, on the plane surface of a tooth, when affected by decay, is usually first opaque and of a chalky whiteness, but may become brown or blackened.

In interstitial decay the defect in the enamel, being out of sight,

usually escapes detection, and the first evidence of its presence is given by a darkening of the underlying dentine, which darkening shows through the enamel, and in the case of a front tooth is first observable on the lingual or labial surface, and in the case of the back teeth usually on the masticatory surface (see Fig. 243 A). The amount of discoloration varies, sometimes a distinct black spot being visible, and showing through the enamel, in other cases a smoked appearance or a slate colour being imparted to the affected quarter of the tooth, the variable depth of shade being dependent on the distance from the enamel surface at which the decayed dentine lies, and also upon the character of the decay.

Decay at sides of teeth that are in contact.

Discoloration often the first visible sign.

In young teeth, with their deficient density, decay runs a rapid course, and the pulp, being larger, is quickly exposed. The teeth of women during the term of pregnancy are apt to decay rapidly, and to be peculiarly sensitive—a reason for having them put in good order in anticipation of that event.

Treatment of Decay.

Treatment.

To stay the progress of decay in the hard structures of the crown two methods are practised, viz. "cutting-out" and "stopping." In either case the affected dental structures must be thoroughly removed and the cavity obliterated.

"Cutting-out" decay is accomplished by removing adjacent sound enamel and dentine, together with the diseased portion, in such a manner that there is left an even surface of hard and healthy tooth, which should be well polished. The full depth to which disease has affected the dentine should be ascertained before the adoption of this method, which should only be had recourse to in healthy mouths, and only in cases where the cut surface will be exposed to friction.

Cutting-out.

Stopping consists in the removal of diseased structure, in the giving to the resulting cavity a retaining shape, and the insertion into it of a stopping which is made flush with and accurately adapted to the edges of sound surrounding tooth structure.

Stopping.

The accurate preparation of the cavity and its edges are of the highest importance in stopping.

In practice, cutting away and stopping are often combined. Dentine left exposed should always be well polished, and if sensitive, spirits of wine may with advantage be applied to it daily, or it may be touched with chloride of zinc, or in the back of the mouth nitrate of silver or a spirit solution of tannin may be applied to it.

Various materials are used for stoppings.

Materials used in stopping.

Gold, skilfully inserted, gives the best results when the tooth is in a condition to bear its introduction.

Amalgams (among which the so-called gold amalgam is very good) can be introduced into a cavity in a plastic state, and therefore can be packed round corners and adapted to thin walls that might not bear the pressure necessary to consolidate gold.

Amalgams.

Prepared gutta percha, from its non-conduction of heat and cold, is valuable as a temporary filling, and is particularly well adapted for cavities which pass below the gum; in positions where it is not exposed to the wear of mastication it sometimes lasts for years.

"Osteo"-stoppings, consisting of oxychloride or oxyphosphate of zinc, have the advantage of clinging to the walls of the cavity, which

consequently requires less shaping; they are also non-compressible, which, with their property of non-conduction, renders them valuable as temporary fillings where the pulp is almost or quite exposed. They will not last long if in contact with the gum, and are not to be trusted in interstitial fillings; but for stopping large cavities on the masticating surfaces of teeth in which the pulp is almost exposed, "osteo" is a most valuable substance; and if it wears away on the surface some of it may with advantage be left in the lower part of the cavity, while the upper part is packed with gold. A saturated solution of mastic in spirits of wine (or some such preparation), mixed with cotton wool, is serviceable as a temporary filling when a carbolic-acid dressing has to be retained in the tooth for any time not exceeding a fortnight.

Whatever stopping is used the cavity should be kept absolutely dry while it is being filled.

The front upper teeth, which are very liable to interstitial decay, can (especially in the young) be temporarily separated by wedging them apart, thus allowing of their being filled from the side or lingual surface without interfering with their contour or leaving the stopping visible; B and C in Fig. 243 show how hidden cavities in other situations can be reached and stopped, if they cannot be got at by a gradual process of wedging.

Exposure of pulp to be avoided.

In shaping cavities for filling, the proximity of the pulp with its outstanding cornua has to be borne in mind, and its exposure avoided. (*See* Molar, in D, Fig. 243.)

If a healthy pulp is exposed in preparing a tooth for stopping, a cap of some non-conducting material, which has been moistened with carbolic acid, should be at once placed over it, and then a stopping introduced. (*See* Bicuspid, in D, Fig. 243.)

Ulcerating condition of pulp.

If an exposed pulp has become inflamed at the point of its exposure, and has taken on a secreting action, repeated dressings with carbolic acid or encalyptus oil and iodoform, to get rid of this ulcerating condition, may be had recourse to; and if successful a stopping may be introduced over the capped pulp; but, as a rule, if the pulp has shrunk away from the aperture of exposure, or been the seat of continued pain, it cannot be preserved with comfort, and the best treatment in such a case consists in rapidly bringing about its death by the application of arsenious acid, and then, when it is devitalised, by withdrawing it and thoroughly filling the pulp chamber and its root extensions. *See* Bicuspid, in E, Fig. 243.)

Devitalization and extirpation of pulp.

The accompanying series of drawings, A, B, C, D, E, Fig. 243, illustrate progressive disease in a tooth and its treatment.

FIG. 243.

Progressive decay illustrated, with its treatment at its several stages.

A



Represents the masticatory surfaces of second upper bicuspid and first molar. The darkening of the decay beneath shows through the enamel on the bicuspid. A searcher is introduced to explore the mesial surface of the molar for decay.

B



The same teeth; the front surface of the molar, having presented superficial decay, has been chiselled down, which gives space for stopping instruments to be brought to bear upon the deeper cavity in the bicuspid.

C



The same teeth with decay more advanced. The cavity in the front of molar, proving too deep for "cutting-out," is reached by stopping instruments introduced *vid* the cavity in the bicuspid. The latter tooth, having had the enamel on its masticatory surface too much undermined for preservation, will have its contour restored by a stopping introduced into the dovetailed-shape cavity, here seen from above.

D



Represents continuation of disease as seen in vertical section of lower bicuspid and first molar. In the bicuspid the pulp has been just exposed, but being healthy has had a carbolised cap and a non-conducting stopping placed over it, and has developed a protective shield of secondary dentine. A gold stopping is seen in the molar, of a shape that would ensure its retention if solid. Commencing decay is also shown at the masticating surface of this tooth.

E



Same teeth. The pulp of the bicuspid is supposed to have been destroyed with arsenious acid and withdrawn from the pulp chamber, which, with its extension to the end of the root, is represented as filled, the lost portion of the crown being also restored. The effects of unchecked disease are seen in the molar, the anterior root being occupied by purulent fluid, and its apex bathed with pus of an alveolar abscess. The posterior root, in which some living pulp still remains, is represented as exostosed, but might with equal truth have been depicted as covered with thickened and inflamed periodontum.

When a pulp has been extirpated immediately after its loss of vitality the root canals should be stopped to their apices forthwith, but when a dead pulp has remained in a tooth for any time a thorough purification by the use of antiseptics must precede the stopping.

In some cases after the pulp has been extirpated, instead of filling the roots, an alternative plan must be adopted if the tooth is to be saved.

This consists in drilling a fine canal beneath the free edge of the gum into the emptied and cleansed pulp chamber, which is then covered over with a cap and superjacent stopping.

Fig. 244.



Rhizodontropy.

Fig. 244 represents a tooth so treated—the gum in this case acts as a valve opposed to the ingress of food, &c. The vent (which may be made through a stopping), by preventing the accumulation of fluid or gas in the pulp chamber, stays the development or allows the subsidence of inflammatory mischief about the root.

Pivoting.

Pivoting.—When no other teeth want replacing and the crown of one of either of the six upper front teeth is lost through fracture or decay, the operation of pivoting a new one on to the root is much to be preferred to other modes of attachment.

Fig. 245.



The ordinary operation.

In the case of a healthy root the crown can with advantage be pivoted on it once for all, after the end of the canal has been filled with gold or other durable stopping; but in other cases the following mode of operating is to be preferred:—The canal at the end of the root is left open, and the new crown is affixed to the root by a split gold pin, which is sheathed in a platinum tube fixed with stopping into the rifled barrel of the root. Here the tooth crown can be removed and replaced at pleasure, while the root is preserved from further decay by being lined with metal, and by this method a root not fully formed, or one that is the subject of alveolar abscess, may safely be used for supporting a pivoted crown. (See Fig. 245.)

Pivoting with vent.

Decay at its commencement is, as a rule, capable of satisfactory and quite or comparatively painless treatment. The difficulties of its successful treatment increase with its onward progress, while the nerve complications that have been noticed, and the severe inflammatory lesions which will be enumerated further on, are most frequently the sequelæ of neglected decay.

Fracture of Teeth.

Fracture of teeth.

Teeth, especially projecting upper incisors, are liable to be fractured. If only a small portion of the crown is chipped off, the fractured edge may be smoothed with a file or stone, and touched with spirit to keep it hard and insensitive (filing to amend shape should not be had recourse-to while the patient is very young). If the portion broken off is so large, that the tooth will be permanently disfigured and yet the pulp has escaped destructive irritation, the remainder of the crown may be removed and a new crown pivoted on to the root; in a young subject the destruction of the pulp preparatary to pivoting should be postponed until it is reduced to its ultimate tenuity by the perfecting of the root.

Treatment according to extent of.

If it is evident that the pulp has become inflamed through the fracture it will be desirable to at once destroy and extirpate it, in order that the periodontum may be preserved in a healthy condition, and therefore the root be in a position to carry a pivoted crown with

comfort. In young subjects, when the teeth are much crowded and relatively prominent as compared with those in the lower jaw, it may be desirable to extract the fractured tooth and to train-in the neighbouring teeth to occupy its site.

Arrested decay.

Arrested or Carbonised Decay.—Sometimes in young subjects when the enamel is lost almost simultaneously over the whole masticating surface of a molar tooth, decay becomes arrested, the exposed dentine assuming a dark mahogany or black colour, and presenting a density which qualifies it for mastication. Such a result may be aided by the rounding-off of projecting enamel edges.

Erosion.

Erosion.—Occasionally the enamel and subjacent dentine are gradually lost by a process which was called by Hunter "decay by dehudation," and by recent writers erosion. The surface of the cavity so formed remains hard and polished and often free from discoloration. It is probable that this gradual wasting away of the tooth substance, without any of the ordinary appearances of caries, is due to the combined action of chemical solution and friction; the enamel in the first instance being affected over a comparatively large area, the dentine, when reached, is exposed to friction which prevents its softening.

This erosion may affect other parts of a tooth, but usually attacks the labial surface at the neck; frequently many teeth in the same mouth are affected by it, a groove being gradually scooped in the teeth just above the gum until the pulp is exposed.

Treatment.

TREATMENT.—An alkaline mouth wash should be prescribed; horizontal brushing interdicted, and if the exposed dentine is sensitive either of the solutions mentioned at page 663 may be applied to it. In cases admitting of it, stopping should be had recourse to, that the pulp may be preserved from exposure.

Affections of the Pulp.

The dental pulp.

An exposed dentinal pulp is subject to mechanical, thermal, and other irritation. The pain produced by such irritation is of a sharp lancinating character, sometimes passing away with an ache.

Its various diseased conditions.

Chronic Inflammation.—Circumscribed superficial inflammation with increase of sensitiveness may be developed in the pulp at the point of exposure, and may continue for a long time in an unsuspected cavity, giving rise to reflex pain or (so-called) neuralgia.

Ulcerative Condition.—The exposed surface of the pulp may take on a secretive action, and the tooth be free from pain as long as the exuded sero-purulent fluid finds an exit, and the pulp escapes fresh irritation.

Acute or general inflammation of the pulp is attended by terrible pain of a violent throbbing character, which, after lasting several hours or days, may cease as suddenly as it began, its cessation betokening the death of the pulp. In this case every factor for the production of agonising pain is present, the distensible pulp, largely supplied with nerves, undergoes vascular engorgement within an unyielding case—closed-in at all parts except at the aperture of exposure—through which it may bulge and suffer further constriction. The pain is not usually confined to the faulty tooth, but spreads from it to the neighbouring teeth and to the side of the face; during the paroxysms the tooth often becomes tender to pressure, owing to a sympathetic irritation of the peridontal membrane. Prompt measures

should be taken to prevent the products of decomposition which result from the sphacelus of the pulp from passing beyond the interior of the tooth and so causing the inflammatory involvement of the periosteum and the formation of alveolar abscess.

The pulp occasionally loses its vitality without producing noticeable pain.

Tardy Destruction of the Pulp.—Instead of losing its vitality at once the pulp may die piecemeal, the chronic irritation that attends this process being often productive of morbid changes on the exterior of the root. A pulp chamber that contains the remains of a decomposed pulp emits a strong and peculiar phosphatic smell.

Calcification of pulp has been described already under the head of *Secondary dentine.*

Hypertrophy of.

An insensitive polypoid growth of the pulp, consisting of granulations which throw off a secretion and readily bleed, sometimes projects from the pulp chamber into a cavity in the crown of a tooth; it usually necessitates the extraction of a tooth on account of the successful resistance it offers to extirpation.

A sensitive sprouting of the pulp may follow fracture of a tooth. Extraction would be the treatment for this condition, which, by extirpation of the pulp, should be prevented from developing, if the retention of the root is desirable.

Necrosis of pulp from blow, &c.

Necrosis of the pulp may occur within the unopened pulp chamber of a sound tooth. It is most often consequent on a blow (sometimes a very slight one) rupturing its vessels as they enter the apex of the root. It may supervene on fever. A darkening of the whole tooth results, and is due to the permeation of the dentine by the decomposed colouring matter of the blood.

Salter has pointed out that the pulp thus devitalised may be disposed of by fatty degeneration. In the absence of treatment (*i. e.* extirpation of the pulp, &c.), it often leads to alveolar abscess.

A tooth knocked out and immediately replaced may become quite firm and obtain vital connection with the alveolo-dental membrane, and will then be in the same condition as the above. In this case or in cases of transplantation the replacement of the dead pulp by an indestructible filling is required to prevent after inflammation. Death of the pulp will be evidenced by the absence of sensation in a tooth when touched with an instrument hot enough to evoke sensation in its neighbours.

Affections of the Alveolo-dental Membrane.

Periodontitis.

Dental periostitis may be local or general, chronic or acute.

Constitutional forms of.

General inflammation of the periosteal investment of the teeth and their sockets results from rheumatism or attends on a debilitated or unhealthy condition of the system, and demands constitutional treatment. When slight in amount and causing only a loosening of and sense of fulness and uneasiness about the teeth, no local treatment may be required beyond the use of an astringent mouth wash. When

Treatment.

the gums are also congested they should be scarified and a stronger astringent (tannin dissolved in spirits of wine is efficient) applied to them. Tincture of iodine is a favourite application with some. Any root or tooth that may be an excitant of inflammation is best removed,

and tartar should be thoroughly got rid of from beneath the free edges of the gum.

The continuance or oft-repeated recurrence of a congested condition of gum leads to the absorption of the alveolar edge and consequent loss of implantation for the teeth; the gradual deposition of tartar upon the root, besides being one of the commonest causes of this condition, is apt to attend upon and increase it when arising from other causes. When the periosteal inflammation is more acute and pus is formed about the necks of the teeth, a solution of chloride of zinc—8 grs. to the ounce—will be found a beneficial mouth wash and will correct fœtor.

The general symptoms of dental periostitis have been given at page 657; it may be added that, when due to rheumatism, toothache is apt to be present, and swelling and suppuration absent, and that it will often subside of itself, while in a scrofulous subject, or when due to syphilis, the pain is often slight, and the tendency to suppurative inflammation marked, and that in these cases the loss of the teeth is imminent, and that their extraction at once may be desirable. Periostitis of the alveolar process of the jaw, leading to necrosis, may be caused by a primary syphilitic chancre (apt to be mistaken for a gum-boil), also syphilis in its tertiary stage, by sloughing of the gums, by acute alveolar abscess, or may have a traumatic origin. Causes various.

Rigg's Disease.—In dyspeptic patients the above conditions occur in their greatest severity. The tumid gums, congested with venous blood, are detached from the necks of the teeth, from about the roots of which a thick fetid discharge can be pressed up. The roots of the teeth are gradually denuded of their periosteum, and are covered by hard, dark-green nodules of tartar, while the receding edges of the alveoli disappear by caries. Rigg's disease.

TREATMENT.—The local treatment of this condition consists in free scarification of the gums, a thorough removal with fine special instruments of the encrusting tartar, and the application of strong carbolic acid introduced on thin slips of wood between the root and the socket which is deserting it.

Rigg, who called marked attention to this condition, recommended the removal (with strong scraping instruments) of the affected margins of the alveoli; but the thorough antiseptic treatment above described seems as satisfactory as can be expected.

The fumes of phosphorus, productive of "phosphorus necrosis," probably find a readier ingress when the pulp of a tooth is exposed, and other irritants productive of periosteal inflammation may act through the same channel. Phosphorus necrosis.

Necrosis of the alveolar portion of the jaw in children may follow either of the exanthemata, and will not always lead to the loss of the permanent teeth if due time is given for the separation of the necrosed portion. Necrosis following the exanthemata

Inflammation of a subacute type may attack the periodontum of one tooth after another, and lead to their successive loss in cases where the roots of the teeth are exposed through the recedence of the gums and alveolar margin from senile absorption or other causes.

Local Dental Periostitis.—With the exception of the condition just named, inflammation attacking the alveolo-dental membrane of a single tooth results from pre-existing disease in the tooth, or is due to some local cause of irritation, such as a ligature applied carelessly for regu- Local periodontitis.

lating purposes or for fracture of the jaw, the accumulation of tartar, or the undue and oblique pressure of an antagonist tooth. Chronic inflammation and thickening of the periodontum is often complicated either as cause or effect with exostosis or with a very small chronic alveolar abscess about the apex of a stump, and is, in these cases, associated sometimes with severe neuralgia.

Dental cysts.

The Dental Cysts which sometimes form on the roots of teeth are probably generally the outcome of conditions which in their more sthenic form lead to the formation of alveolar abscess. An alveolar abscess may pass into a cystic condition, and it is certain that these cysts (which may contain cholesterine) may suppurate, and then to all intents and purposes they become converted into alveolar abscesses.

Alveolar Abscess.

Periodontal inflammation of an acute form, producing Alveolar Abscess, is the natural sequel of death of the pulp, the products of the decomposition of this structure passing through the foramen at the end of the root, giving rise to it. Pus formed between the root and its investing membrane, may separate the latter from the former and escape around the neck of the tooth, in which case, if the dentinal pulp is also dead, the tooth becomes absolutely necrosed, and is to be regarded as a foreign body. Pus may become diffused beneath the gum, and this is especially likely to occur in the case of lower impacted wisdom teeth. Far more commonly, pus, derived from the pulp chamber or due to the breaking down of inflammatory lymph, which has been thrown out about the apex of the fang, is contained in a circumscribed abscess, which embraces the end of the root (*see* Fig. 243, 2), and occupies an excavation in the maxilla. Preventive treatment consists in the complete clearing out of the root canals and their thorough purification by antiseptics; this, with the administration of a saline purgative and the local abstraction of blood from the gum over the root, affords the best chance of cutting short periodontal inflammation that tends to the formation of abscess. The formation of an alveolar abscess is usually preceded by great local tenderness to pressure on or over the root of the tooth, and attended by pain of a throbbing character, sometimes by rigors and considerable constitutional disturbance. The possible occurrence of pyæmia from this cause is not to be overlooked. Great serous effusion into the cancellated bone and the soft surrounding tissues not infrequently takes place, mistaken sometimes for erysipelas and occasionally resulting in suppuration; the closure of the eye of the affected side, or a swelling from the lower jaw reaching half down the neck may thus be produced. An abscess connected with an upper molar sometimes causes a fulness over the lower jaw. When an abscess is formed the contained pus tends to find an exit either through a gumboil (so-called), or by a fistulous opening on the face, &c.; an opening on the gum being naturally formed when the mucous membrane is reflected from gum to cheek at a distance from the alveolar border, and a canal through the body of the bone, if the root of the tooth extends below such reflection of the mucous membrane.

Its formation.

Preventive treatment.

Symptoms.

A possible cause of pyæmia.

Gumboil.

An alveolar abscess attached to the upper teeth may perforate the antrum, when attached to an incisor may open into the nares, or when connected with a lateral incisor may pass backwards between the compact layers of the palatine process of the superior maxilla or between the periosteum and the hard palate, and open through or behind the wh

palate. It may also form fistulous openings on the face near the inner canthus or under the edge of the malar bone. An alveolar abscess connected with lower incisors may open under or in front of the chin, and above or under the margin of the jaw when connected with the other lower teeth; from a wisdom tooth the pus may pass forwards to the canine, backwards to the fauces, or escape at the angle of the jaw. Pus from an alveolar abscess may pass down the neck, and in one case it found final exit below the clavicle, and in another and fatal case it reached the armpit. Fistulous openings on face, &c.

The pus of an alveolar abscess that distends the mucous membrane of the gum or cheek should, of course, be evacuated by an incision, if the extraction of the tooth does not suffice for the purpose. A chronic gumboil may be regarded as a safety vent; but abscesses with such a fistulous opening on the gum may sometimes be cured by pumping carbolic acid through the root of the tooth until it escapes on the gum, followed up by stopping of the root.

When alveolar abscess has formed, and does not tend to open on the gum, but causes a distension of the bone over it, together with local inflammation, the tooth, as a rule, should be extracted without delay to prevent further mischief, although in some cases a clearing out of the pulp chamber and the performance of rhizodontropy, coupled or not with a direct opening into the abscess to evacuate the pus, may be the right practice. Treatment of alveolar abscess.

In alveolar abscess of the lower jaw, a prominence passing out from any diseased tooth and obliterating the natural sulcus between gum and cheek will point to the tooth which should be extracted, and a vertical incision across the abscess track within the mouth may be advisable to prevent the next step in the formation of an external fistulous opening, namely, the distension and thinning of the skin preparatory to its perforation. In these cases warm water should be held in the mouth, and poultices should *not* be applied to the outside of the face.

A fistulous opening on the face, which has given exit to a continual discharge for years, will at once close up on the extraction of the tooth or buried root which has caused it, but a permanent depressed cicatrix will be left; in these cases a probe introduced from the outside will very likely impinge on something which feels rough and hard like dead bone, but is really an exostosed and roughened tooth fang; absence of fœtor in the discharge and singleness of the opening point to the presence of a diseased tooth and not bone disease. Diagnosis.

Serious local Complications of Inflammatory Action set up by Tooth Disease.

The disfigurement of a fistulous opening on the face, due to neglected alveolar abscess, is comparatively common, but far more severe complications are sometimes but very rarely produced by the inflammatory involvement of surrounding structures. The seventh nerve has thus been involved, producing facial paralysis. Necrosis of the involved bone has led to a fatal result. Several cases are detailed by Salter in which permanent loss of sight in one eye followed antral abscess or inflammation about the upper teeth. In one case amaurosis of thirteen months' duration was got rid of by the extraction of a carious tooth from the end of which a splinter of wood projected. In the case of a

Case of dental caries resulting in death.

patient who recently came with symptoms of tumour in the orbit into Guy's and there died, Dr. Goodhart traced the origin of mischief to caries of the first left lower molar, which gave rise to abscess, suppuration in the inferior dental canal, acute ostitis of left side of lower jaw, extension of disease by pterygo-maxillary fossa to orbit, suppuration in both orbits, ostitis of vault of skull, and pyæmia.

The spasm of the masseter which frequently attends disease about the lower back teeth is sometimes probably due to inflammatory involvement of the nerve, and not simply to reflex irritation. Extraction of the tooth is its cure, and the mouth may be opened sufficiently to allow of this being accomplished by the persevering use of a wedge between the teeth.

Salivary calculus.

Tartar or salivary calculus consists of lime salts precipitated from the oral fluids, together with "leptothrix buccalis," epithelial scales, &c.; it especially tends to form on the lingual surface of the lower front teeth, and on the buccal surface of upper molars; a small rim may be often found on all the teeth under the free edges of the gum, which may then present a narrow blue line or be generally congested. Brushing in the manner recommended for the prevention of decay checks its deposition. Its presence in large mass may cause ulceration of the tongue, &c., and in much smaller quantity causes loosening, and if allowed to accumulate, the loss of the teeth. It should be carefully and thoroughly removed with small scaling instruments, used so as not to make the gum bleed.

All teeth that are retained in the mouth should by stopping and scaling be rendered as sound and firm as possible. A patient with tartar-loaded and decaying teeth may travel for fresh air, but will hardly find it.

Epithelioma set up by jagged points of teeth.

All sharp and jagged edges of teeth should be removed by a file; this is of special importance in after-life, as localisation of epithelioma of the tongue is frequently traceable to irritation so produced.

Tumours and other Affections of the Gums.

The gums.

Sundry gum affections are intimately connected with the teeth.

Hypertrophy of.

Simple hypertrophy of the gums, chiefly on their labial surface, is sometimes met with when the teeth are overcrowded, the gum being shut out, as it were, from between the necks of the teeth. The preventive treatment for this condition is self-evident, but when it is established, and extraction is inadmissible, it may be reduced by free scarification and the application of tannin, &c.

Occasionally, in unhealthy subjects, hypertrophy assumes larger proportions, the crowns of the teeth being buried in lobulated masses of gum. The treatment consists of scaling, free scarification (and sometimes excision), together with the local use of astringents and fetor-correcting applications. Absorption of the underlying alveolus, and consequent loss of implantation for the teeth, is apt to attend upon this hypertrophy, as it does upon continued extra vascularity of the gums.

Polypus of.

A polypus of the gum is frequently found to project into dental carious cavities which extend below the gum; it is vascular and insensitive, and should be cut away and packed out of the tooth cavity

preparatory to the filling of this latter. This gum polypus is sometimes liable to be mistaken for polypus of the dentinal pulp.

Epulis.—The tumours classed under this name present, in varying proportions, a fibrous or myeloid character, and not infrequently have small osseous development at their basis. As regards the maxillæ, these growths essentially belong to the alveolar or tooth-bearing portion, and consequently can, as a rule, be completely removed without interference with the basal portion of the bone. The fibrous tissue of the gum, the endosteum, and the alveolo-dental membrane having continuity, may each share in the development of an epulis; it therefore follows that for the complete eradication of the disease, the extraction of an adjoining tooth or root may be demanded, together with the excision of the growth and involved bone. Epulis. Its connections.

Vascular Tumours.

Mr. Salter has recorded a case of a vascular tumour, the size and colour of a Morello cherry, which he found attached by a narrow neck to the periosteum of a tooth. In my own practice a lobulated tumour, of polypus character, and having much the appearance of an epulis, overlapped the hard palate, and was found to be attached by an exceedingly narrow pedicle to the edge of the periosteum of a decayed molar tooth. In both these cases hæmorrhage of a really alarming extent had occurred, and in both the tumour was removed by extracting the tooth. Vascular tumours.

The painful "Ulcerative Stomatitis," so frequently met with in hospital practice among young children, often demands the extraction of loosened and irritating teeth, coupled with the internal administration of its specific remedy, "chlorate of potash." Ulcerative stomatitis.

The Extraction of Teeth.

Speaking generally, extraction may be required for regulation of teeth, which includes the prevention of overcrowding. To prevent or get rid of impaction of a wisdom or other tooth. For neuralgia and nerve irritation when its origin in a tooth is not confined to some condition of the pulp which can otherwise be got rid of. As a rule, in cases where periodontitis (not rheumatic) is established and resists curative treatment. When an alveolar abscess tends towards opening externally. In cases of vertical fracture of the tooth. In the case of loose and diseased teeth or roots which keep up an unhealthy condition of the mouth. When an epulis has probable connection with alveolo-dental membrane. And, finally, in some cases to allow of more satisfactory artificial restoration. Extraction, when required.

Forceps and Elevators are the instruments now used for the extraction of teeth. The forceps adapted for the removal of the different teeth will be found described in 'Tomes's Dental Surgery,' and only a few special points will be here noticed with regard to them and their use. Forceps should be finely made and well tempered, with blades which should grasp the tooth's neck without pressing on the crown, as extraction is seldom required for sound teeth, but for those that are broken down or hollowed out by decay. Instruments for.

In extracting a tooth the forceps should be applied lightly and closely to its neck and then sent firmly up (or down, as the case may be) until they grasp a part of the tooth that will resist some pressure; the edges of the blades will thus, as a rule, be made to pass just

within the edges of the socket, while in the case of the molars the points of the blades will take grip at the bifurcation of the roots; the right hold being obtained by this first movement, the instrument is thenceforth kept at one with the tooth, which is first separated by a particular movement from its socket attachments and then withdrawn.

Manner of holding forceps.

The accompanying drawing, Fig. 246, shows the manner of holding forceps. The little finger may be used as a kind of opening spring, and the thumb should act as a stop between the handles and prevent any crushing pressure.

Fig. 246.



Manner of holding forceps.

Particular movements required to dislodge the several teeth.

The particular movement required for the dislodgment of a tooth depends on the shape of its root. Thus, the upper incisors and canines, together with the lower bicuspids, are more or less conical, and are therefore to be rotated, while the lower incisors and canines, together with the upper bicuspids, are more or less flattened from side to side, and therefore are to be moved outwards and inwards. The molar teeth are also to be moved outwards and inwards before being extracted.

Direction in which they are withdrawn.

The direction in which teeth are withdrawn from their sockets depends on the position held by their roots. Upper molars are extracted downwards and outwards; lower molars upwards, and often somewhat backwards; while in order to follow the curves of their respective roots, upper wisdoms should be extracted downwards, backwards, and outwards, while the crowns of lower wisdom teeth should be carried backwards and upwards.

An elevator should not be used in extracting the upper wisdom tooth on account of the fragile nature of the tuberosity of the maxilla in which it is lodged, but may sometimes be used with advantage for a lower wisdom when the second molar is sound and firmly implanted.

Of impacted lower wisdom.

Before attempting to extract a buried and impacted lower wisdom tooth a careful examination should be made with a probe to see how it is situated; sometimes it will be found to hold a horizontal position, its crown impinging upon and causing absorption of the root of the second molar. In cases where it is possible to extract the impacted tooth, lower hawksbill stump forceps with a double curve and an elevator such as shown in Fig. 248, B, will be found very useful. In cases where the ascending ramus would be necessarily injured in attempts to remove the wisdom, the second molar should be extracted, and then the buried tooth may erupt without further trouble, or can be easily removed if still a source of irritation. Stump forceps, as here figured (Fig. 247), are far better adapted for the extraction of bicuspids than the so-called bicuspid forceps.

Of bicuspids.

Use of stump forceps for extracting united roots.

In the case of a much broken-down or hollowed-out lower molar, instead of using molar forceps, it is better to grasp with stump forceps the one of the two roots which offers the best hold, and if the union between the roots is not strong enough to allow of their withdrawal together, the remaining separate root will be easily removed.

The three undivided roots of a crownless upper molar may be extracted with "Coleman's forceps," or with long flat-bladed, loose-jointed stump forceps, as made by Collins.

FIG. 247.



FIG. 247.—A. Upper stump forceps. B. Lower stump forceps.

FIG. 248.



FIG. 248.—Wedge-shaped scoop elevators, which are very useful in extracting buried or much hollowed-out roots, such as C. A. Elevator for upper roots. B. One of a pair of elevators, devised by Mr. C. Rogers, for lower stumps. Such a root as C may sometimes be best removed from the upper jaw with an instrument having a spiral cut on it, used like a corkscrew.

Occasionally dividing forceps may be used with advantage in extracting united roots of either upper or lower molars.

Use of searcher.

When a root is partially covered over with gum the position of its edges should be defined with a probe before any attempt is made to grasp it.

Lancing previous extractio

With well-made forceps, lancing the gums before extraction is usually unnecessary, but sometimes, in isolated teeth, especially wisdom teeth, the gum is strongly adherent to the tooth, and is apt to be torn away with it if not first separated.

Fistulous openings on the face are seldom seen in connection with children's temporary teeth, but the external alveolar plate is often perforated, and the end of a root projects through and causes ulceration, which may lead to adhesion between gum and cheek; the teeth causing this irritation are easily pushed out with an elevator.

Hæmorrh after extractio Its Treatmer

Persistent hæmorrhage following the extraction of a tooth and resisting cold may be stayed by tightly packing the socket with rolls of softened matico leaf (Tomes), or with a strip of lint cut to a point and dipped in a spirit solution of tannin, a compress being placed over and kept in place by the opposite teeth. At the same time astringents or iron should be given internally if the hæmorrhagic diathesis exists, or appropriate measures be taken if the bleeding in the case of a woman appears to be vicarious.

Artificial teeth.

When natural teeth are lost, artificial ones unquestionably conduc to comfort and health.

Gold is generally the best base for artificial dentures when a fe teeth only want restoring, but when the gums have been absorbe and many teeth lost, vulcanite or some such substance is preferabl Various modes of fixing teeth are adopted. Atmospheric pressu alone, bands applied to the natural teeth in the least harmful way, ar occasionally springs (those devised by Mr. Henry Rogers being by f the best), are each to be used in fitting cases.

In elderly people, teeth that project in an unsightly manner can oft be shortened with much advantage and without pain. The roots upper front teeth and of lower teeth, if healthy, may often be retain in the mouth with gain. The wholesale and indiscriminate extracti of teeth is to be strongly reprobated, leading, as it does, to prematu absorption of the alveolar processes, and thus often reducing in mid age the lower jaw to a level with the root of the tongue, and, therefo ill-fitted to support artificial teeth. Several painful cases resulti from extreme absorption, due to this practice, have lately been se by me.

Obturators and soft palates.

In the cases of cleft or perforate palate which are not amenable surgical treatment artificial restoration should be had recourse to.

An obturator should only span the orifice in recent cases of perfo tion, in order that occlusion by the approximation of the edges of t opening may not be interfered with, and in no case should a meth of fixing in the plate be used that will tend to enlarge the aperture.

AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

Inflammation and Suppuration of the Pharynx

Inflammation of pharynx.

is met with in the feeble and cachectic subject, and comes on w general and local symptoms, not unlike those of quinsey, indeed, the t affections are often associated. The chief local symptoms are p and swelling, with difficulty in swallowing, and the chief gene symptom, fever with constitutional disturbance.

Abscess of pharynx.

Abscess, which may be the result of an acute or chronic inflam tion of the part, shows itself by some bulging or projection of mucous covering of the pharynx, and it may be so large as to interf with if not prevent deglutition, or even to impede respiration. I h seen this occur at least twice in cases of spinal disease. When th conditions exist, the abscess must be opened, and the best instrument use for the purpose is a straight bistoury protected up to the point a piece of lint or strapping. Tonics, such as quinine, iron, or t mineral acids, are almost always required in these cases. Steaming t throat gives great comfort, as well as external warm applicatio Nutritious food should always be allowed. The Surgeon should remember that a post-pharyngeal abscess may be due to disease of t vertebræ or base of the skull, but such cases are generally chron He should also be alive to the fact that such an abscess may be as ciated with a fracture of the spine (*vide* Fracture of Spine, p. 322).

Tumours of the pharynx may also give rise to the external appea

ances of a chronic abscess by pressing the mucous membrane forward, cancerous tumours are very liable to do this. One of the most marked cases of the kind I ever saw which turned out to be a syphilitic gumma, was so large as to make me suspect its cancerous nature; it was cured by ten-grain doses of the iodide of potassium in bark three times a day. Tumours of pharynx.

The cancerous tumours generally commence in the upper part of the pharynx, and cause obstruction of the posterior nares; as they grow downwards they simulate a pharyngeal polypus. Two such cases in young people have been under my care, and terminated fatally. It was a question in both whether the disease was not originally in the tonsil, but it appeared to have originated above the gland.

Granular pharyngitis, or hypertrophy of the adenoid tissue of the pharyngeal mucous membrane, shows itself as a chronic catarrhal affection, associated with the secretion and hawking up of a thick viscid mucus, which is often tinged with blood. Granular pharyngitis.

There is also at times a constant burning sensation in the throat, and frequently a nasal twang in the voice. There is likewise commonly deafness. To the eye the pharynx presents a granular appearance, the granules at times being as large as peas. I have at times seen them larger—once as large as half a nut.

TREATMENT.—There is but one form of treatment of use, and that is the removal of the glandular bodies by scraping or the galvanic cautery. When the disease is limited the latter practice is preferable, but when extensive scraping should be employed, the operation not only removing the new tissue, but starting up a new action in the membrane, which is beneficial. Tonics and the local application, later on, of glycerine and iron expedites cure.

Soft polypi grow occasionally from the pharynx. In 1883 such a case came under my care in the person of a man, æt. 80. It had been growing two years, and was about the size and colour of a large mulberry. It sloughed off after much manipulation. Polypus.

Dysphagia

is a symptom due to a variety of conditions, and it may arise either from some want of power in the pharyngeal muscles or from œsophageal *ulceration* or obstruction. In the former case, the condition may be due to a paralysis of the muscles of the part from cerebral disease, hysteria, or a previous diphtheria—a more or less complete loss of power in the act of swallowing existing under all these circumstances—food or fluid passing into the nose or the larynx producing suffocation. This condition is, moreover, often present after the operation of tracheotomy for croup; the want of adaptive power in the muscles of deglutition allowing liquid food to travel down the larynx and appear at the external tracheal wound. Dysphagia is only a symptom. Its causes.

Dysphagia from œsophageal obstruction may be brought about by either spasmodic or organic stricture of the tube itself, secondary to cancerous, syphilitic, or simple ulceration. It may be produced likewise by pressure from a thoracic, cervical, or aneurismal tumour, or by the presence of a foreign body in the tube. Laryngeal and pharyngeal tumours, and tumours about the base of the tongue, can also roduce the same symptom. When due to œsophageal obstruction.

Stricture of the œsophagus, as a rule takes place at its junction with

Stricture of the œsophagus. Varieties.

the pharynx behind the cricoid cartilage, though it may occur at other parts. It may be *spasmodic* or hysterical, but more frequently it is associated with some simple, syphilitic, or cancerous *ulcerative* action; occasionally it is *cicatricial*, the result of a former injury, such as the swallowing of a corrosive fluid. In the majority of cases, however, the disease is due to cancer. It is a great question whether a simple fibrous stricture of the œsophagus, such as is found in the urethra, ever takes place. *Thoracic aneurism* is capable of producing every symptom of this affection.

Spasmodic stricture.

Spasmodic or hysterical stricture is usually met with in the young, but it may be found at all ages. Paget has described it as a kind of stammering of the muscles. It is probably always associated with some local irritation, follicular inflammation, or ulceration, which has either originated by itself, or followed an injury such as a scratch from the passage of a hard or sharp body. It is, moreover, usually associated with dysphagia. The dysphagia is likewise intermittent and uncertain; and a patient, when given food or fluid to test her power, will often say that it is impossible for her to do what is required, and should she attempt to swallow she will to a certainty half choke. Yet, at other times, when otherwise engaged, food can be taken. If a probang be used to examine the part, its introduction will be violently opposed by the pharyngeal muscles, though with a little steady pressure all obstruction will be overcome.

Œsophageal Obstruction.

Œsophageal obstruction.

When a patient complains of difficulty in swallowing, or rather of difficulty in passing food onwards down the œsophagus after the act of swallowing has been performed, and of its subsequent return into the

May be due to aneurism, cancer, or ulceration.

mouth, the Surgeon, in looking for its cause, should first think of thoracic aneurism, then of cancer of some portion of the tube, and, lastly, of simple or syphilitic ulceration. He should also always inquire into the history of the case, and satisfy himself that in no previous period has the patient sustained any local injury from the swallowing a foreign body, of boiling water or corrosive fluid. If the last cause be eliminated, and a careful examination of the chest with other modes of investigation dispose of the question of aneurism, then that of cancer becomes the most important, since there is little doubt that such, in the majority of cases of organic stricture of the œsophagus, is the true cause. The minority includes examples of simple and of syphilitic ulceration or contraction. In the early stages of the affection the diagnosis is difficult; indeed, at this period, the Surgeon is seldom consulted, for so long as solid food passes, the patient is hardly aware of any obstruction existing, the habit of swallowing small boluses of food growing *pari passu* with the obstruction. An attack of spasm is, perhaps, the first symptom that attracts notice, a spasm which completely closes the canal, and causes *regurgitation* of the food.

Means of diagnosis.

Difficult in early stage.

Signs of ulceration.

At this early period of the disease the Surgeon will probably be able to pass a probang, though it may be only a small one. As the disease progresses some signs of ulcerative action may appear, such as the discharge of pus or blood, which usually comes up with the regurgitated food, and when this occurs there is no better indication of the presence of ulcerative action. If the patient be middle aged, the probabilities of the disease being of a cancerous nature are very strong, and should

Cancerous variety.

re be any local thickening behind the larynx, or glandular enlarge-
nt these probabilities are enhanced. When, however, the patient
a young adult, and a history of syphilis exists, its syphilitic nature is Syphilitic variety.
idered probable. Simple or syphilitic ulceration of the œsophagus
sufficient of itself to cause complete œsophageal obstruction, and to
mulate stricture, the spasmodic contraction of the muscles of the
be having much to do in bringing about this result. The following
se, which occurred in a patient of Dr. Habershon's, illustrates these
ints very forcibly:—The patient, æt. 48, was dying from starvation Example.
used by inability to swallow on account of œsophageal disease, and
it I performed the operation of gastrostomy. The man lived six Gastrostomy.
ys afterwards, and died of pneumonia. After death nearly a complete
g of ulceration was found at the upper part of the œsophagus, which
d caused all his symptoms. Its syphilitic nature could not be decided,
hough the man gave a history of having had the disease twenty years
eviously. The repair at the seat of operation was most complete, the
mach and integuments having firmly united. No peritonitis existed.
I once saw, in consultation with Mr. Pink, of Greenwich, and Dr.
ilks, a case of complete œsophageal obstruction, which we all believed
be cancerous, but which so far improved under the expectant treat-
nt as to allow of the passage of well-minced food with comparative
nfort. Several months later, however, complete dysphagia returned,
d the man died, a direct communication having taken place between
œsophagus and the respiratory tract from extension of the cancer-
ulceration. Had a bougie been passed in this case a fatal result
uld probably as a consequence have taken place.

s the disease progresses other symptoms will appear, for the ulcer may Ulceration extending into air-tube.
its way into the larynx or trachea, when it soon proves fatal. It is
this fact that the Surgeon should always be very chary of passing a Caution in use of probang.
gie down the œsophagus, and more particularly when there is any evi-
e of the presence of ulceration, since he will be very liable to do harm
may cause perforation of the ulcer into the air-passages, or pleura.

EATMENT.—Assuming the pathology of stricture of the œsophagus Treatment by dilatation.
has been given to be correct, the treatment by dilatation must
ked upon as a dangerous measure, *except* when the stricture is of
atricial form; the passage of an instrument in cancerous or any ul-
e disease being likely to hasten the fatal termination of the disease.
cicatricial form, however, or that which follows some local injury, Useful in the cicatricial stricture.
s can be produced by an irritant or caustic fluid, dilatation is of
alue, and such treatment, if it does not cure the disease, will at
olong life. A bougie as large as can be passed should be
ed daily and retained. The patient should, when possible, take
d finely minced, and when otherwise fluid nourishment. Milk Diet.
n be drunk when other food is refused. Beef tea is always
nd Hassall's flour of meat mixed with it is an excellent addition.
liquid essence of meat is also invaluable.
swallowing becomes impossible the cautious passage of a fine
be through the stricture for the introduction of liquid food
ndertaken; and my colleague, Mr. Durham, has advocated its
the tube in some cases irritating less by its retention than
quent passage. The practice seems a good one when it can
d. Nutritious enemata are always of great use; beef tea
with flour or arrowroot, with milk and egg, or part of a

Enemata.

mixture of a pound of minced beef and one third of a pound of fresh pancreas, as a suppository, administered every four hours alternately, tending more than anything else to keep up the powers of the patient. When all these means fail, or rather before—for it is known that life cannot be very long maintained under such circumstances—the question of opening the stomach by an operation must be entertained.

Gastrostomy.

Billroth recently has cut down upon the œsophagus and excised the cancerous growth, but without success; the operation is only commended to our consideration by the eminence of the Surgeon who performed it.

Wounds of pharynx.

Wounds of the pharynx, as a result of accident, are occasionally met with, falling with a sharp body in the mouth being the most frequent, and when they do not involve any large vessel they generally do well. Durham relates a case of a boy, æt. 7, in 'Holmes's System of Surgery,' third edition, vol. i, p. 745, in which Mr. Johnson, of St. George's, had to ligature the carotid artery for repeated bleedings following a punctured wound of this part, produced by the end of a parasol, in which an excellent recovery ensued.

Foreign Bodies

Foreign bodies in pharynx. Symptoms.

are occasionally arrested in the pharynx, and, when pointed, may become fixed in the soft parts about the base of the tongue, or between the pillars of the fauces: but when bulky and solid they are generally arrested at the narrowest portion of the tube, its lowest portion, behind the cricoid cartilage, or at the cardia. The discomfort caused by this accident is at times very great, and difficulty in swallowing, pain, and the disposition to vomit are common symptoms. A pricking sensation in the part is generally present when the substance is pointed, although it must be remembered that this symptom often remains after the substance has been dislodged. Where the epiglottis or upper orifice of the larynx is irritated, cough and other laryngeal symptoms will be produced, and the same may be said when a solid body becomes impacted behind the larynx; the larynx under these circumstances being either so compressed as to cause suffocation, or so irritated as to give rise to spasm, either of these causes being sufficient to produce death.

May cause abscess.

When small bodies lodge in the part they may give rise to inflammation and abscesses in the pharynx and neck; indeed, instances are on record in which disease of the cervical vertebræ has been the result.

May be impacted.

Coins may be impacted in the pharynx for many months, and Dr. O. Ward relates a case ('Path. Trans.,' 1848-9) in which a halfpenny was so placed for eight months, the child at last, in a fit of coughing, bringing it up.

Treatment.

Exploration.

TREATMENT.—Whenever a foreign body, large or small, is suspected to have become lodged in the pharynx, a surgical exploration of the mouth, base of the tongue, and fauces should be made, and by carefully sweeping these parts with the index finger any foreign body will be detected. By this proceeding the foreign body may be dislodged.

Use of forceps.

When any body is fixed in a part it may be removed by forceps, the ordinary dressing forceps, as a rule, sufficing; when the body is lower down the revolving œsophageal forceps, as made for me by Mr. Krohne, of Duke Street, Manchester Square (Fig. 249), may be used. When a coin has been swallowed by a child, and become impacted in the pharynx, the child should be laid across a pillow upon his belly on a table, with the head hanging over the end, and supported. The Surgeon should then introduce his finger into the mouth and depress the child's tongue, the coin by this manœuvre sliding out of its place.

When a solid mass has become impacted in the lower part of the pharynx behind the cricoid cartilage, and the finger cannot dislodge it, no forcible attempt should be made to push it down into the stomach, although laryngotomy may be called for to preserve life. If a second attempt to move the impacted body fail, it is well to desist, as by the lapse of time the spasm which existed when the first attempt failed may disappear, and a renewed effort may be crowned with success. Soft bodies likewise become softer, and consequently can be the better removed or pushed downwards. A good deal may, however, be done by digital manipulation, both inside and outside the mouth, either to dislodge the foreign body or to so alter its shape by squeezing as to enable it to pass downwards. The laryngoscopic mirror is often of great service in detecting the presence of a small impacted body, and in guiding the Surgeon to its position. False teeth not infrequently become dislodged and impacted in the pharynx. Paget has related such a case, where a man in a fit had one of his sets in the pharynx, where they remained four months. They were afterwards dislodged from between the base of the tongue and the epiglottis.

Laryngotomy.

Force never to be used in pushing body down.

Examples of impacted false teeth.

FIG. 249.



Revolving pharyngeal forceps for the removal of foreign bodies, &c.

'Med. Times,' 1862.

Before giving chloroform to old people the teeth always should be examined, and false sets removed. When such bodies become impacted, much care is needed in their extraction, and the utmost gentleness used.

Care in extraction.

Foreign bodies in the œsophagus are mostly arrested at the two narrowest portions of the tube—its origin behind the cricoid cartilage, or at its lower end just above the diaphragm—and anything that can be swallowed may be so impacted. The symptoms to which this accident gives rise are extremely uncertain. When the upper part of the tube is obstructed the laryngeal symptoms are generally alarming (Fig. 250), and when the obstruction is not complete, they may be very slight. Vomiting, however, under both circumstances, will probably take place to expel the obstructing body, and when this is severe "*rupture of the œsophagus*" may ensue. This accident is to be suspected, when, after severe and repeated straining the foreign body is ejected with violence, its ejection being attended with hæmorrhage and followed by emphysema of the neck. An interesting paper on this subject may be referred to, by Dr. Fitz ('American Journal of Med. Science,' January, 1877). As a rule, however, besides the mechanical symptoms which the mere presence of a foreign body in the tube produces, secondary inflammatory symptoms may be set up, which may give rise to a fatal result. Thus, a case is on

Foreign bodies in Œsophagus.

Symptoms.

Rupture of œsophagus.

May perforate heart, aorta, &c. &c.

record, in which a fish bone perforated the heart and caused a fatal hæmorrhage (Andrews, 'Lancet,' 1860); in another, where a sharp spiculum of bone caused ulceration on the third day into the aorta (Hume-Spry, 'Path. Trans.,' vol. xix., p. 219); and in a third, where disease of the spinal cord ensued as a consequence of ulceration of the intervertebral substance, following the arrest of a piece of bone in the œsophagus (Ogle, J. W., 'Path. Trans.,' vol. iv, 1853). Erichsen also records a case in which a piece of gutta percha formed for itself a bed in the wall of the œsophagus for upwards of six months, and destroyed life by causing ulceration into a vessel and hæmorrhage, and a second, in which a man died suddenly from hæmatemesis, the cause being discovered after death to be a half-crown impacted in the œsophagus, ulcerating into the aorta. Gairdner likewise gives a case where a fish bone passed through the posterior wall of the œsophagus and was found embedded in pus in front of the vertebral column ('Med.-Chir. Soc.,' Edinburgh, 1859), and my friend Dr. Sutton also has told me of an instance where a lunatic so plugged his pharynx with tow as to cause death by suffocation.

Fig. 250.

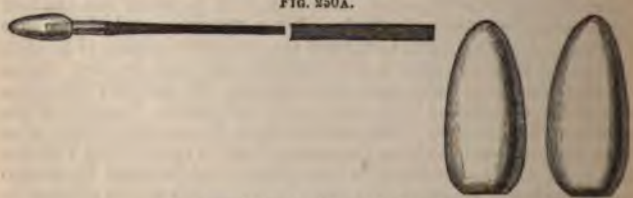


Preparation showing a piece of pudding impacted in œsophagus of a child, æt. 2 years, which caused death by laryngeal spasm. Guy's Hosp. Mus., 1793[40].

Diagnosis.

Diagnosis.—It is impossible for a surgeon under all circumstances to say with certainty as to the presence or absence of any foreign body in the œsophagus. When it can be felt by the finger or bougie, no doubt can be entertained; yet, on the other hand, when no such evidence is obtainable a foreign body may often be present, and being of small size may become so fixed in one side of the tube as to escape detection in the passage of an instrument. The best bougie for diagnostic purposes is one made of whalebone, with a smooth polished iron knob at its end, the one with a sponge at the end being useless (Fig. 250A).

Fig. 250A.



Œsophageal bougie with metal olivary end.

Treatment. If soft or digestible *may be pushed down.*

Treatment.—When a foreign body is detected, the sooner it can be taken away the better. If the material be soft and digestible, it

may be pushed downwards by means of an ordinary sponge or ivory probang or the tube of a stomach pump, care being taken not to use force, for such material will soften by the natural secretion of the part after the lapse of a few hours, and thus will be more readily pressed on. Should, however, the offending body be pointed, hard, or large, all idea of pushing it on must be dismissed, such a practice being most dangerous, although it has been done with impunity; a jagged plate with teeth having been pushed into the stomach and passed per anum. *Small* Horsehair probang.

Fig. 251.



Horsehair probang expanded and unexpanded.

pointed bodies may be caught by the "horsehair" probang (Fig. 251), passed carefully beyond the position in which the foreign body is supposed to be placed, and then gently expanded, rotated, and withdrawn, the compression and rotation of the instrument causing the hair to spread out and to expand the œsophagus. The addition of a skein of silk to the extremity of the probang adds at times to its value. *Sharp-pointed bodies or impacted hard irregular bodies* should, when possible, be removed by forceps. Those figured in No. 249 are the best, as they can be made to open when in the pharynx in all directions. Forceps.

Vomiting will often cause the dislodgement of a foreign body, though at times it may render it more fixed. When vomiting cannot be produced by the administration of medicine, a solution of tartarized antimony, or of apomorphia gr. $\frac{1}{10}$, injected beneath the skin is said to act as well. Emetics.

Fig. 252.



Money probang, with sponge at one end.

Coins and other flat but not pointed bodies can often be removed by means of the money probang (Fig. 252) or Graafe's coin catcher, the circular hook catching the coin and drawing it upwards.

Swallowing a large bolus of bread may carry downwards any fine bone or bristle, a draught of any liquid assisting the process.

Œsophagotomy for the removal of foreign bodies has an established position in practical surgery, and the principles laid down many years ago by Arnott, are now generally accepted, viz. "where a solid substance, though only of moderate size and irregular shape, has become fixed at the commencement of the œsophagus, or low down in the pharynx, and has resisted a fair trial Œsophagotomy for removal of foreign bodies. [Med.-Chir. Trans.; vol. xviii.

for its extraction or displacement, its removal should *at once* be effected by incision, although no urgent symptoms may be present." Mr. Cock endorsed this opinion when he wrote in 1867: "The longer a foreign body is allowed to remain, unless we wait—a forlorn hope—for suppuration to loosen it, the more firmly it will become impacted. It would appear that success attends a speedy operation; whereas, where the use of the knife has been delayed until local inflammation, suppuration, or even sloughing has been established, the result of the operation has been fatal." Dr. D. Cheever, of Boston, U.S., likewise urges it. Up to the end of 1882, 45 cases of this operation for the removal of foreign bodies have been recorded, and of these 35 were successful, and in the fatal cases, the result was more from the delay than the operation.

For stricture and cancer of œsophagus. 'Guy's Reports,' 1858, 1867.

Statistics.

Œsophagotomy for stricture.

This operation has been recently advocated in cases of stricture, cancerous, or otherwise, with the view of introducing food permanently into the stomach, but the results of the operation are not sufficiently satisfactory to enable me to advise its adoption. It is only possible when the seat of stricture is high up, and advisable when the stricture is of the cicatricial form; under other circumstances, gastrostomy should be preferred.

Operation of œsophagotomy. Mode of performance.

The Operation.—The patient should be placed in the recumbent position, with his shoulders slightly elevated, the head being turned to the right or left side, according to the point of projection of the foreign body. Where this guide is lost, the left side should be selected, the œsophagus inclining rather to that side. An incision should then be made along the anterior border of the sterno-mastoid muscle, about four or five inches long, its centre corresponding to the position of the foreign body, and all the soft parts carefully divided. The omo-hyoid will then come into view, and underneath this, the carotid sheath, with its vessels, will be seen. The deep cervical fascia is then to be laid open, and if more room be required, the sterno-hyoid and sterno-thyroid muscles may also be partially divided. The vessels with the sterno-mastoid muscle should then be drawn well outwards by means of hooked retractors. The larynx, with the œsophagus behind, can then be examined, and the position of the foreign body accurately made out, pressure with the finger on the opposite side tending materially to make this point clear. Should the foreign body project, the larynx may be drawn well forward, or towards the opposite side, and a cut made down upon the projecting part, the wound being carefully enlarged to allow of an extraction without force. When the foreign body does not project, a guide should be used, such as a silver catheter, flexible lead or tin sound, or a long pair of forceps introduced through the mouth downwards into the pharynx, the point of the instrument pressing forward the œsophageal wall. All vessels that bleed during the operation should be at once twisted or ligatured. On opening the œsophagus, the recurrent laryngeal nerve should be carefully avoided. The wound should be left open. The patient must be fed for a few days by means of a small œsophageal tube, introduced through the mouth into the œsophagus below the wound, care being taken during its introduction to keep the point against the opposite wall. Convalescence, as a rule, goes on steadily. I have been fortunate enough to see the operation successfully performed twice by my colleague, Mr. Cock, and the facility with which it was done has given me a very favorable opinion of its value.

CHAPTER XIV.

INJURIES OF THE ABDOMEN.

Contusions and Rupture of the Viscera.

INJURIES of the abdomen, like those of the cranium, derive their principal importance from the nature of the cavity's contents. The integuments and muscles that form the abdominal parietes may be severely injured, and results follow which are simply of local importance; but when the peritoneal lining of the cavity is involved, or any of the viscera are injured, the case assumes a grave aspect. The gravest internal abdominal injuries may, however, coexist with the slightest, or with no external evidence of mischief, and even without shock. When a wound is present, an extra element of danger is added, which is to be measured by the extent and character of the visceral complication.

Contusion.

Under certain conditions, a trifling blow on the abdomen may give rise to symptoms of an alarming nature, when a severe one may be recovered from without exciting more than a fear. "The absence of shock immediately succeeding a severe lesion may lull suspicion, as its presence may by simple contusion excite alarm." Every abdominal injury, however trivial it may appear, must consequently be regarded with apprehension, and the utmost care observed in its treatment. This can be easily accounted for, says Poland "when we consider the numerous and vital structures contained in the abdomen: a serous membrane highly prone to inflammation; the 'peritoneum,' occupying an extensive amount of surface; a lengthy coil of organised tubing, 'the stomach and intestines;' solid substances, made up chiefly of blood-vessels, &c.; the liver, spleen, and kidneys readily lacerable and liable to rupture, causing nearly always fatal hæmorrhage; receptacles for fluid, 'the gall and urine bladders,' which, under distension and undue force, may burst; large vessels coursing along the posterior wall, 'the aorta, vena cava,' &c.; and lastly, above all, the sympathetic nerves, consisting of the solar plexus and its numerous satellite plexuses and branches of such high organic importance, that injury or shock thereto may be attended with irreparable results. All these structures are, moreover, enclosed with soft elastic parietes, capable of great distension, which, although readily able to resist shock and external violence without injury to themselves, yet may allow the force to be transmitted and expended on the contents with dire effect, and yet without leaving a trace or mark in the exterior."

General remarks on the abdomen.

'Guy's Rep.,' 1858.

Diagnosis of the effects of contusion difficult.

In forming a diagnosis in this class of cases, exclusion is the only sound method; every possible complication should be entertained and dismissed only when the weight of evidence is against it, the ultimate conclusion being founded as much on negative as on positive evidence.

"I am unacquainted," writes Le Gros Clark ('Surgical Diagnosis,' 1869), "with any diagnostic sign by which we may predicate whether shock following an abdominal injury exists primarily, apart from, or as expressive of actual breach of texture. Time alone can develop the true nature of the case, either by renewal of vigour or by the development of fresh symptoms."

Only developed in the progress of the case.

An injury to the abdomen from a blow, fall, or the passage of a wheel over the part, may cause either a more or less severe contusion of the abdominal wall, with no visceral complication whatsoever; or

Symptoms as a guide.

a laceration or rupture of a viscus or vessel, which will end in death, without any (or very slight) external sign of mischief.

Collapse.

Shock or Collapse, as a direct consequence of a blow, when of a passing nature, is of small value as a diagnostic sign; although when *persistent* or *relapsing* it indicates great mischief; as more or less complete collapse is a common effect of all abdominal injuries. A collapse, however, coming on at a distinct interval of time after an injury, as a rule indicates internal hæmorrhage.

Relapsing collapse.

Pain.

Pain as an immediate effect of injury is no indication of internal mischief, for in simple abdominal contusions it is at times very severe. When, however, it *lasts* or becomes *fixed*, it is a symptom of importance; and when it *radiates* from a point, it is most characteristic.

When radiating.

Persistent vomiting.

Persistent vomiting is always a suspicious symptom of visceral injury.

Sudden death from shock.

How far sudden death is attributable to a shock or collapse from a blow on the epigastrium or stomach without organic lesion is not yet a settled question. Dr. A. Taylor, in his 'Medical Jurisprudence,' adduces a case, that of Mr. Wood, in which a man, when fighting and intoxicated, suddenly died after the receipt of a left-handed blow on the pit of the stomach; but the evidence in the case, as well as the facts revealed at the post-mortem, were by no means conclusive as to the cause of death. The opinion has probably been accepted on the authority of Sir A. Cooper, who was in the habit of relating that as two men were working, one of whom was wheeling along a heavy load, his comrade thus addressed him: "That is too much for you; stand aside, and let me, a better man, take it." He accompanied these remarks with a slight blow on the scrobiculus cordis, and the man immediately let the barrow fall and died on the spot. After death no lesion was discovered. The case, however, had only been related to Sir A. Cooper.

Sir A. Cooper's case.

Surgeon Harding's case.

Surgeon A. Harding, of the Army Medical Department, in his 'Report,' 1881, vol. xxi, Appendix No. vii, gives a case, "the history and post-mortem appearances of which apparently point to sudden death, the result of shock to the sympathetic system of nerves, paralysing the cardiac plexus, and thus causing cessation of the heart's action. The man, as far as can be ascertained by inquiring of his intimate comrades and examination of his medical history sheet, had been previously perfectly healthy, thus excluding heart disease, and no traces of injury being found, lead fairly to the above conclusion." The case was that of J. Coyle, an officer's servant, who in driving away a pony from his master's tent, received a kick from the animal over the region of the liver. He at once said to a comrade standing near him, "I'm done for," and fell down dead. Dr. Harding saw him so five minutes after the accident. At the autopsy, made twenty-two hours after death, all the viscera were found healthy. Lungs collapsed; heart full of fluid blood; liver normal in size, but full of blood; spleen and kidneys also full of blood. I concur, however, with Mr. Pollock, that "sudden death attributable to a blow on the stomach or epigastrium must be a rare occurrence; and that medical men should be extremely guarded in offering an opinion as to the cause of death in such supposed injuries, without satisfying themselves by most careful and minute post-mortem investigation, that no violence has been done to the viscera, either abdominal or thoracic." ('Holmes's System,' 3rd edit., vol. i, p. 867.)

Pollock's remarks.

What then, it may be asked, are the usual consequences of an abdo-

minal injury or contusion? and what are its risks and complications? The following facts will answer these queries.

At Guy's Hospital, during eight consecutive years, seventy-one cases of abdominal injuries were admitted. In *seventeen* cases, or about one fourth of the whole number, rupture of the viscera took place. In *forty-four*, beyond a passing collapse, and tenderness over the injured part from the contusion, no evidence of any internal mischief showed itself. In these cases rest in bed for a few days, with the local application of a warm fomentation, was the chief treatment, and in all, convalescence was rapidly established. In *ten cases* symptoms of *peritonitis* followed, as evidenced by excessive tenderness over the injured part, increased by movement, thoracic respiration—resulting from the indisposition of the abdominal muscles to act, and the pain caused during that action by pressure on the inflamed peritoneum—nausea, and in some cases vomiting. Fever, and constitutional disturbance, varied according to the severity of the inflammation. In seven of these ten cases, *absolute rest* in the horizontal posture, warm local applications, either by means of fomentation or cataplasms, in some instances leeching, and *in all, opium* given in moderately full and repeated doses was the treatment adopted; and in every case the inflammation was subdued before it had attained a dangerous degree of severity. In the remaining *three cases*, however, acute peritonitis set in, which in one terminated fatally. As a type of an ordinary case of peritonitis after injury, I adduce the following case:—

Effects of contusion in 71 cases.

Ruptured viscus in 17.

Passing collapse in 44.

Peritonitis in 10.

A man, æt. 22, received from a woman, while fighting, a blow on his right side, which was followed by syncope, but from which he soon recovered; no pain or inconvenience followed the injury for a week, and the man resumed his usual occupation. At this date severe abdominal pain appeared at the seat of injury, which rapidly increased and spread over the whole abdomen; vomiting also began, accompanied with considerable constitutional disturbance; and in this condition he was admitted into Guy's. He was put to bed, twenty leeches were at once applied to the seat of injury, and a grain of opium given, which was ordered to be repeated three or four times daily; perfect rest was also enjoined. In a few days these symptoms subsided, and he was enabled to take food without vomiting, pain ceased, and convalescence became gradually established.

Typical example of peritonitis after blow.

Remarks.—Such a case is interesting from the fact that some days elapsed between the receipt of the injury and the appearance of the peritoneal symptoms, as well as from the important practical point to be learnt from the rapid success that followed upon the treatment which was pursued. Rest, to its fullest extent, was doubtless the chief element of success—rest by position in the horizontal posture, and rest of the injured parts maintained by the administration of opium. It is not unfair to maintain that if this treatment had been adopted earlier, the symptoms exhibited would never have made their appearance; but the man following his occupation, the repair which was required after the injury could not be efficiently carried out, and, as a consequence, inflammation ensued. Of all cases, abdominal injuries require absolute rest, and in no example, however apparently trivial, should it be neglected. If the mischief is but little, that little will more rapidly be repaired; if great, its evils and its consequences will be materially modified. The case already quoted indicates both points, viz. its primary necessity and its secondary good results.

Remarks on the case and treatment adopted.

Importance of rest.

It is thus seen that a blow upon the abdomen may be followed by a simple contusion of the abdominal wall, and, in exceptional cases, by peritonitis, which may terminate fatally, although in the majority where such a result ensues, it is from rupture or lesion of some internal part. A local peritonitis after an injury is not, however, to be looked upon with displeasure, for, as pointed out by Mr. Hilton, the coagulable lymph which is poured out under these circumstances forms a temporary splint until the injured structures repair themselves. The inflammatory effusion produces a certain degree of rest to the injured structures, and thus contributes to the work of reparation.

Signs of ruptured viscus obscure.

What, then, are the symptoms of an internal abdominal lesion? How can the presence of such be made out? And what guides are there to the viscus that is wounded?

Proximate guides.

To answer these questions satisfactorily much space is needed, more, indeed, than can be well spared in this work; yet helps to diagnosis may be given, and among these the nature and position of the injury are the best. Where the loins are the part involved, the kidneys are most likely to suffer; where the right hypochondriac region, and the ribs on that side are fractured, the liver is probably the organ that may be injured. When the injury is on the left side, the stomach, or more probably the spleen; when in the umbilical region, the intestines; when in the pelvic region, the bladder are the organs involved.

Ruptured liver.

Rupture of the liver usually destroys life by hæmorrhage, and in the majority of cases within a few hours of the injury; in some, within a few days. Thus, out of nine consecutive cases of ruptured liver, five died rapidly, three survived, three, seven, and nine days respectively.

Recovery may ensue after ruptured liver.

There is little doubt, however, that recovery may take place when the fissure is limited and the case uncomplicated. Preps. 1948—1951[5] in Guy's Hosp. Museum, with drawings, illustrate this truth. Such cases, when they occur, are classed with those of traumatic peritonitis, and when they prove successful their true nature is not revealed.

Extensive.

When the laceration is *extensive*, death is always speedily produced by the shock and hæmorrhage; coldness and general pallor of the whole body, with a feeble pulse, sighing respiration, and restlessness preceding the fatal issue. When the laceration is *less severe* life may be prolonged; and I have recorded in another work the case of a man, æt. 45, who, when drunk, fell from a cart, and the wheel was said to have passed over his head. Intoxicated to an extreme degree, he was admitted, under Mr. Birkett's care, into Guy's Hospital, presenting no collapse or symptom of abdominal or even cranial mischief, beyond slight hæmorrhage beneath the right conjunctiva. He was put to bed, soon fell asleep, and on the following morning, with the exception of the hæmorrhage into the orbit, *no signs* of mischief could be detected. Rest, however, in the horizontal position, was strictly enjoined; but to this he would not submit, and thirty-six hours after the accident he got up, walked about, and with a sudden pain in his side fell back and died. After death, a fissured fracture of the skull was found, passing across the right orbit, without brain complication, and about a pint of blood in the peritoneal cavity, which had evidently escaped from a severe laceration of the liver—a mass situated in the right lobe the size of a man's fist having been nearly separated. The right kidney was also fissured on its surface, and covered with coagu-

Slight.

lated blood. In this case the man clearly died from secondary hæmorrhage, the result of the ruptured liver. In October, 1883, a boy, æt. 16, *walked* into Guy's Hospital, although in pain, after the wheel of a cart had passed over his abdomen. There were no external signs of injury, and the only prominent symptom was vomiting. He appeared to be doing well when on the fifth day, after an action of the bowels, he suddenly died. After death a fissure three inches in depth was found in the right lobe of his liver, filled with clots and covered with lymph.

In rare instances the liver may be crushed partially, and, strange to say, its peritoneal covering be uninjured; yet in such cases life can be prolonged, and, when the mischief is not extensive, may be saved.

Fissures of the liver are usually met with on its upper surface, and a diseased organ is more liable to rupture than a healthy one.

Ruptured spleen.

The spleen is frequently injured, and such cases are by no means always fatal. Prep. 2018, Guy's Museum, illustrates its repair after injury. This organ, too, is sometimes lacerated by a fractured rib, or torn by a dragging of its surface. When fatal, the result occurs from hæmorrhage or peritonitis. A child, æt. 5, was run over and admitted with fracture of the *left* ribs and lower jaw. He had no abdominal symptoms. On the tenth day he sat up, when symptoms of acute peritonitis set in, followed by death on the twelfth day. After death pleurisy and fractured ribs were found, with blood in left loin and four ounces of blood and pus between the surfaces of a ruptured spleen.

Subdiaphragmatic abscess.

Subdiaphragmatic abscess may occur as a consequence of abdominal injury, and the Surgeon should suspect its presence in all cases where recovery is slow and attended with abdominal pain.

Ruptured stomach.

Rupture of the stomach generally proves fatal from shock or irrecoverable collapse; the amount of distension of the organ, its contents, and the extent of laceration, influencing the result. When the rupture is large and effusion of its contents into the abdominal cavity takes place, acute peritonitis, with or without hæmorrhage, will prove fatal, if the shock does not. When the rupture is small, and the stomach empty, there is some chance of recovery, local peritonitis subsequently gluing the injured part to the surrounding tissues.

Symptoms and result.

When death is not immediate the patient will complain of an acute and constant pain radiating from the seat of injury, so peculiar, indeed, that "the intensity of it absorbs the whole mind of the patient, who, within an hour from the enjoyment of perfect health, expresses his serious and decided conviction that if the pain be not speedily alleviated he must die" (Poland). Vomiting is a constant symptom, first of the contents of the stomach, and often afterwards of blood; collapse, rigors, and syncope are often met with.

Incomplete rupture of coats.

Incomplete rupture of the coats of the stomach is found sometimes after death, and in Guy's Museum (Prep. 1817[35]) there is the stomach of a child, æt. 7. in which, from a sudden blow upon the distended viscus, the mucous membrane was detached and lacerated in a remarkable manner.

Ruptured intestine.

Rupture of the intestines, both large and small, is a somewhat common form of abdominal injury, and may be produced by a fall, a blow, the passage of a wheel over the abdomen, or even violent muscular exertion. Hennen ('Military Surgery') gives a case where a soldier received a contusion of the abdomen, and sloughing of the integument followed

Examples.

with artificial anus, yet in six months the fæces resumed their natural course and a recovery took place. In Guy's Museum there is a specimen (Prep. 1851[85]) of perforation of the small intestines of a man who had received a kick from a horse, and died thirteen days after the accident with extensive peritonitis, from fæcal effusion. Prep. 1851[86] consists of a portion of jejunum, taken from a man who had been kicked in the abdomen, the injury being quickly followed by symptoms of extravasation and death in forty-eight hours; Prep. 1850[88] was taken from a case of perforation of small intestine from the kick of a horse, terminating in death in twenty-four hours; No. 1851[89] is a portion of jejunum in which are two openings through which the mucous membrane is inverted and resulting from a kick in the abdomen; No. 1851[91] is an example of laceration of the jejunum, in which the bowel is completely divided. It was taken from a man, æt. 37, who had been run over by a cart, and lived twenty-four hours. Lastly, the specimen marked 1851[87] is from a case that occurred in the practice of my father, the late Mr. T. E. Bryant of Kennington, and is a portion of ileum in the coats of which there is a small perforation, the injury being produced by running against a post, and followed by collapse, from which the patient did not rally, but died on the third day.

Recovery after sloughing of intestine.

Cases are also on record in which, after an injury, a portion of intestine has sloughed and subsequently passed per rectum, a recovery taking place. In the Anatomical Museum of the University of Edinburgh several such preparations exist.

Ruptured deodenum.

The duodenum is rarely ruptured, its position protecting it; nevertheless such an accident does occur. Taylor, in his 'Medical Jurisprudence,' gives a case where a boy æt. 13, after a blow on the abdomen, walked a mile with but little assistance, and, when he died (thirteen hours after the accident), the duodenum was found to be completely torn across. In a case of my own a man, æt. 25, walked into Guy's after an abdominal injury. He lived thirty-six hours, and after death his duodenum was found ruptured.

Ruptured jejunum.

The jejunum is doubtless more frequently ruptured than any other part of the intestines, its fixed position rendering it liable to be torn away from the duodenum by such an injury as the passage of a wheel over the abdomen. Poland gives fourteen examples of this kind, and in half of these the laceration was at its upper part. In one case, after death, three or four pints of thin pink-coloured fluid was found in the abdomen, probably the iced water of which he had freely partaken after the accident, and in all, death took place from collapse and peritonitis. A man, æt. 40, received a kick on the abdomen from a horse. He walked to the hospital, but did not appear to be very ill. He was admitted for precautionary reasons. He died suddenly in thirty-six hours, and after death fæcal extravasation was found, and a perforation in the jejunum three feet from the duodenum.

Ruptured ileum.

The ileum is also frequently ruptured, and most commonly from a direct blow or fall on a hard body. In the majority of such cases there is no external mark of injury, and fæcal effusion with peritonitis are the usual causes of death. When the rupture is large, little hope exists of a recovery; when small, such a hope, however, may be entertained. In these cases death is usually rapid; in the following case, however, of a man, æt. 21, who was run over, and vomited, death did not take place for eighteen days. It followed an action of the bowels, and after death

a coil of intestine three feet from the cæcum was found lacerated and adherent.

When a patient is the *subject of hernia* and receives a blow upon the tumour, a ruptured intestine may doubtless take place. Aston Key made this the subject of a memoir in the 'Guy's Reps.' for 1842, and Poland has collected many such cases in the same periodical for 1858. Rupture of the gut is the usual result of such an accident, and when it occurs, a fatal termination is to be expected. When the bowel is only bruised, however, it may recover or slough, and be followed by an artificial anus. Blow on hernial tumour.

In none of these cases when symptoms of inflammation or of injury are severe should any attempt at reduction be made. The surgeon should, however, explore the sac. In all recorded cases where the bowel has been returned, a fatal result took place.

The large intestine is rarely ruptured from violence. When over-distended from fæcal accumulation the result of stricture or otherwise, such a result may ensue; but, under ordinary circumstances it is too well protected. I have, however, known florid blood to flow from the bowel after an abdominal contusion, and have, from that fact, suspected some laceration of the colon. Ruptured large intestine

TREATMENT.—The chief point to insist on is the absolute necessity of treating *every case* of injury to the abdomen with excessive caution, as very severe mischief may be caused by violence and yet the immediate symptoms not be marked. Collapse after the injury, as has been shown, is by no means a necessary consequence; for rupture of the intestine itself may take place without exciting such a condition; and a patient may walk after a ruptured liver or intestine. The surgeon, therefore, should be guarded in his prognosis as well as careful, watchful, and expectant in treatment. Treatment of ruptured intestine.

Collapse, when present, unless it threatens to be fatal, should be disregarded, since it may have a most beneficial influence, in checking or preventing bleeding. Of collapse.

In every case absolute rest in the horizontal position should be secured and maintained. If the injury be slight, convalescence will soon be established by such treatment; if severe, secondary bad results may be prevented, and, at any rate, be relieved. The application of cold to the injured part gives comfort and by checking the circulation does good. A Leiter's metallic coil is the nicest mode of applying it (Fig. 8½,) or an ice poultice or bag when the coil cannot be obtained. In some cases fomentations or cataplasms give greater comfort. In exceptional cases when local pain from peritonitis is great, the application of 20 or 30 leeches gives relief. Opium should always be given in small and repeated doses, such as one grain every four or six hours for an adult. It allays pain, assists by checking peristalsis in maintaining rest to the injured peritoneum and viscera, and tends materially to arrest inflammatory action. Rest. Cold. Opium.

The patient should be kept free from all excitement, and as little nourishment administered by the mouth as will suffice to sustain life; if the intestines are believed to have been ruptured, *starvation* treatment must be carried out. Whatever is given should be liquid and cold. Milk and ice in limited quantities is the best and simplest combination, and upon this life can be sustained without difficulty. If great thirst exists, ice may be given; but this must be given with caution, as the ice Starvation.

Nutrient enemata.

case already quoted well illustrates. When the intestine is believed to be injured, the allowance of fluid must be very scanty, the patient's powers being kept alive by enemata of beef tea administered in small quantities, say three or four ounces repeated every four or six hours.

Never administer purgatives.

On no account ought a purgative to be administered. This rule is golden in these cases, and should never be deviated from; as by infringing it in a careless moment, the whole of nature's processes in repairing the injury may be undone, and irreparable mischief follow. Constipation is the sign of a passive condition of bowel to the preservation of which all our treatment is directed; a purgative is merely an irritant, and in its effects in these cases absolutely destructive.

Cautious prognosis. Always examine the bladder.

In all cases the prognosis and treatment should be most guarded, cautious and expectant; and, in all, the *state of the bladder* should be well attended to, for retention of urine from disturbed nerve influence is a common accompaniment and must not be overlooked. No case of abdominal injury, however trivial, can be pronounced well within a fortnight.

Ruptured kidney.

Rupture of the kidney is an accident from which recovery is more common than from any other viscus, and its position in the loins outside the peritoneal cavity, is doubtless a sufficient explanation of this fact. When the injury is not very severe and uncomplicated with other injuries, such cases usually do well. It is generally known by an attack of hæmaturia and local pain following the blow on the lumbar region. The hæmaturia may be but slight and passing, or not show itself till the second day. It may cease also after the lapse of two or three days, when it is probable that only a contusion of the kidney had taken place, for in more severe injuries the bleeding may last fifteen or even more days. At times clots will be passed, assuming the shape of the ureter, and I have before me the notes of some half dozen cases in which these symptoms were present, and from which recovery took place. These clots, however, at times give rise to retention of urine by blocking up the urethra. Retraction of the testicle is an occasional symptom, and so is pain in the course of the ureter and along the course of one of the lumbar nerves.

Symptoms.

Treatment.

The treatment to be pursued in these cases is, rest in bed and milk diet. In cases where the bleeding is profuse the tincture of ergot in full doses is a valuable drug or a grain of the acetate of lead may be given with half a grain of opium, three times a day, or gallic acid in ten-grain doses. Opium should always be given with caution.

When the organ is crushed the injury is likely to be complicated with other mischief, and, under such circumstances, peritonitis and hæmorrhage, singly or combined, generally prove fatal. When the organ is single, and becomes injured, a fatal result is also likely to occur. In page 125 of my 'Clinical Surgery' I have recorded such a case. When peritonitis exists opium is of great value; where urinary abscess in the loin follows, as it occasionally does, particularly in gunshot wounds, the Surgeon must make a free incision into it on the outer border of the quadratus lumborum muscle.

Ruptured ureter.

Rupture of the ureter was first noticed by Stanley in the 'Med.-Chir. Trans.,' vol. xxvii, and in the two cases he related a fluctuating tumour formed by the effusion of urine existed in both. Poland, in the 'Guy's Rep.' for 1868, has recorded a third case; but beyond these no others are on record. Four cases of wounded ureter are, however, published by Hennen ('Mil. Surg.'). In all these cases it seems the ureter was rup-

tured by stretching, its renal end having suffered; and I have seen two of these which occurred in the practice of my colleague, Mr. Howse.

Symptoms obscure.

The symptoms are very obscure, particularly where no external wound exists; indeed, there are none to indicate the nature of the accident in its early stage. At a later period a lumbar tumour may appear of a cystic nature caused by the retention of the secreted urine, and there may be more or less peritonitis. When a lumbar swelling exists tapping the cavity should be performed, the operation being repeated from time to time as the fluid re-collects, the kidney in time probably ceasing to secrete. When this treatment fails there is little doubt that a free opening into it in the loin is the correct treatment. Nephrectomy may be required. Under other circumstances the case must be treated as all others of abdominal injury, by rest and opium.

Wounded ureter.

Mr. Holmes records in the 'Med.-Chir. Trans.' for 1877, vol. xlii, an interesting case of wound of the ureter, which occurred in a boy, æt. 13, where a clasp knife had entered his body from behind, upwards and outwards, just on the right of the middle line, and about on the level of the posterior superior spine of the ilium. The wound discharged urine for two weeks and then closed, the boy recovering.

Ruptured gall-bladder.

Rupture of the gall-bladder has been recorded as the result of accident, and when it occurs death is usually rapid. The accident is marked by extreme collapse and pain in the seat of injury. Poland, in his 'Fothergillian Prize Essay,' has given us such a case, and Dr. Fergus, in the 'Med.-Chir. Trans.,' vol. xxxi, has recorded another. In one the death occurred from collapse, and in the other from peritonitis.

Ruptured hepatic duct.

Rupture of the hepatic duct may also occur. In Poland's 'Fothergillian Essay' such an instance is recorded, and occurred in a boy as the result of a blow on the abdomen, the accident being quickly fatal. My friend Dr. Sutton has kindly given me the details of a second case, which took place in the London Hospital in 1867. It was in that of a man, æt. 29, who was knocked down, and the wheel of a spring dray passed over his stomach. He felt pain in the right hypochondriac region directly, and "had hard work to get his breath." Abdominal pain increased and jaundice appeared, and for a month he kept his bed. On the thirtieth day after the accident, as he did not improve, he was admitted into the London Hospital, under Drs. Herbert Davies and Sutton. Then he had abdominal pain, tenderness, and distension. There was distinct ascitic fluctuation over the abdomen and deep jaundice. He sank eight days after his admission, and thirty-eight days after the accident. The autopsy revealed the fact that the hepatic duct was torn across a quarter of an inch above the spot where the cystic joins the common duct; no other part of the liver was injured. The abdominal cavity contained quarts of olive-green bile-stained fluid, and the peritoneum was covered with yellow matter of the colour and consistence of paint, which was found to be inspissated bile.

Ruptured urinary bladder. Seat of rupture.

Rupture of the urinary bladder may occur with or without fracture or dislocation of the pelvis. It is usually but not always due to external violence applied to a distended organ. As a rule the rupture takes place at its posterior wall, the urine escaping into the peritoneal cavity, and rapidly causing death. In exceptional cases it affects the anterior wall, when the urine infiltrates the cellular tissue of the pelvis In the former cases the term "*intra*-peritoneal" is applicable, in the latter "*extra*-peritoneal."

In estimating any suspected case, the Surgeon should remember that a distended bladder can scarcely escape from an abdominal contusion, when an empty one may elude the greatest violence; and that a bladder partially distended is more likely to be bruised than ruptured by direct external violence or torn when dragged backwards.

This accident is more common in men than women in the proportion of five to one, and it occurs chiefly in young adults. The *extra*-peritoneal is far less dangerous than the *intra*-peritoneal rupture, but "the accompaniments of fracture and dislocation of the pelvis cannot be said," according to Rivington, "of themselves to exercise much influence in the length of the survival."

Predisposing causes.

The bladder generally gives way in its weakest point. The main predisposing condition of rupture is distension of the organ, but this need not be very great. In exceptional cases, as in one recorded by Rivington, the bladder was empty, the undistended viscus being dragged backwards with the peritoneum when a cart wheel passed over the patient's abdomen. The rupture in this case was in front above the prostate gland.

A second predisposing condition is some obstacle to the exit of urine urethral or prostatic, and where with this obstacle there is sacculation of the bladder, a very little external violence, or vesical contraction only, brings about a rupture.

In 283 fatal cases collected by Rivington, 224 were brought about by traumatic, and 59 by idiopathic causes; that is, in the latter the bladder was ruptured by muscular action combined with over-distension from some obstructive cause such as stricture. I have seen one case of this kind the result of stricture in which the bladder gave way on its anterior or upper wall outside the peritoneum, which got well after free abdominal incision. A rupture from over-distension may be either intra- or extra-peritoneal, according to the condition of the individual bladder. Gross reports that in his cases the peritoneum remained intact in all.

Characters of rupture.

The aperture in the bladder when ruptured is not a clean cut one, but partakes of the characters of a lacerated wound. The edges are more or less jagged and contused, one coat being often torn more than another.

The bladder as a rule contracts after rupture, and it is in only exceptional cases that it holds more than a few ounces. There may be much bleeding from the wound, post-mortem records revealing the fact that a large quantity of blood may be found in the peritoneal cavity after death. Mr. Bransby Cooper stated that in his case three or four pints of blood had been poured out.

Typical symptoms.

Symptoms and Diagnosis.—"The typical primary symptoms of rupture, whether traumatic or idiopathic, are a feeling of something giving way, pain, shock, inability to stand or walk, desire but want of power to micturate, and removal from the bladder with the catheter of blood only, or a small quantity of bloody urine. The deficiency of urine and the loss of power to micturate often continue throughout." These words are those of W. Rivington taken from a recent monograph on the subject (1884), which merits praise as it claims close study. In any given case there may be no external signs of injury, though the abdomen may be swollen, prominent, and tender.

Should an attempt be made to pass a catheter, a variable quantity of blood, or of blood and urine, may be drawn off, and should the catheter by chance pass through the rent in the bladder the quantity of fluid

evacuated may be great. Mr. Durham in one case removed three quarts. The catheter when in the abdominal cavity will probably be passed its whole length and be very movable. Indeed in some cases it has been felt through the abdominal wall. The stream of fluid when it comes from the peritoneal cavity is slow and languid; it may be intermittent. As the case progresses symptoms of more or less acute peritonitis develop.

Should the patient survive the accident five or six days there may be hope of recovery, for repair locally will have gone on and with it both local and general symptoms will have ameliorated. The bladder will then probably begin to act naturally, pain will have diminished, and the patient will be able to take food. Dr. S. Smith reports (1851) three cases in which the inability to urinate continued, and twelve in which it returned on the second or a later day. In extra-peritoneal cases all the primary symptoms will be more subdued than in the intra-peritoneal, and the secondary symptoms will approach those of extravasation of urine elsewhere, such as diffused cellulitis locally, and those of blood poisoning constitutionally.

Treatment.

Treatment.—Up to the present time no definite line of treatment has been laid down, and as a consequence the results of treatment have been most disastrous. Out of more than 200 cases tabulated by Rivington, but eight have been recorded as examples of recovery, and it must be added that in them the evidence of their belonging to the *intra*-peritoneal group is not unimpeachable. Still a careful examination of the evidence afforded by these and other examples is encouraging, and enough to support a line of treatment which is based upon a principle and upon lines which may bring about a good result.

The treatment to be successful must be local; general treatment by itself has been proved to be absolutely useless.

Local.

The indications for local treatment are—*firstly*, to withdraw the extravasated urine from the peritoneal cavity, and, *secondly*, to secure a free exit for fresh urine as secreted.

Laparotomy.

To carry out the first when the diagnosis is clear, laparotomy should be performed by an incision two or three inches in length made above the pubes, through which the peritoneal cavity should be well cleared of all blood and urine, and sponged dry with antiseptic sponges. The rent in the bladder should be closely stitched by a silk suture like that of Lembert's for the intestine, Fig. 254, page 698, and to facilitate this step I would suggest the use of the rectal inflator as described and illustrated (Fig. 325), since by its use the base of the bladder and prostate will be raised out of the pelvis and well into view, thus facilitating manipulation.

Cystotomy.

After this operation and the abdominal wound has been carefully stitched up, cystotomy should be performed for drainage purposes.

Should, however, much difficulty be experienced in suturing the vesical wound, the Surgeon may find comfort in the result of Dr. Walter's case (Ranking's abstract, 1862), in which laparotomy was performed, the abdominal cavity was cleaned and a rent two inches long seen in the fundus of the bladder left alone, the bladder being subsequent to the operation relieved by catheterism, and recovery took place.

When the diagnosis is not sure, the treatment above advised rejected, or the case is late for treatment, a drain for the urine should be made by lateral cystotomy, after which the urine will flow away as secreted. Median cystotomy with the introduction of a tube within the neck of

the bladder is likewise good practice, but it does not satisfy the requirements of the case so well as the lateral.

When a catheter has been passed per urethram into the bladder and probably through the rent into the peritoneal cavity, a free irrigation of the cavity should be employed. Mr. Thorp's case ('Dublin Quart. Journal,' vol. xvi), so far as it goes, tends to support this practice, and Mr. C. Heath strongly advises it.

In extra-peritoneal rupture and urinary extravasation, supra-pubic and possibly perineal incisions may be called for, and a free vent for secreted urine provided by lateral or median cystotomy.

The probabilities of obtaining a successful result in any of these cases turns, however, more upon the time that has elapsed when they are put into execution than anything else, fresh urine not being nearly so irritating to a healthy surface as urine undergoing septic changes, and these when once begun go on rapidly. In Walter's successful cases the operation of laparotomy was performed ten hours after the extravasation, in Willet's and Heath's, unsuccessful, thirty and forty-two hours respectively.

"The records," writes Rivington, "appear strongly to indicate the necessity of bold action. The chances of recovery entirely hinge upon the promptitude of the Surgeon adopting efficient measures. In doubtful cases an exploration with the finger through a perineal incision would be perfectly justifiable and could scarcely introduce any fresh element of danger. If the diagnosis of intra-peritoneal rent be clear at the outset the urine cannot too soon be evacuated by a supra-pubic incision, and the peritoneal cavity carefully cleansed. At the same time a perineal opening may be made with advantage. I am disposed to think sewing up the rent in the bladder unnecessary, provided a free perineal exit be secured for all urine secreted after laparotomy."

The only general treatment should be the administration of opium, a grain of the solid or its equivalent of liquid being given every four or six hours to allay pain and relieve peristalsis.

Food of a simple character should be given all through.

Injury to uterus.

Injury to the uterus, when large from pregnancy, deserves a passing notice, for such cases are serious. A contused organ may inflame, and be followed by abortion or miscarriage, or should pregnancy continue, its structure may be so altered as to be liable to rupture. In obstetric works cases are recorded in which this accident happened. I have known also an intra-uterine fracture of a child's thigh to take place as a consequence of a fall.

Ruptured ovarian cyst.

Rupture of an ovarian cyst from a blow is also recorded, and under certain circumstances a good result may take place; all obstetricians have met with such cases. The removal of the ruptured cyst is probably the best practice to be followed, since if left a fatal peritonitis generally follows.

Ruptured diaphragm.

Rupture of the diaphragm occurs in practice, but it is an accident difficult to diagnose. It is generally the consequence of some violent injury, such as a crush or the passage of a heavy wheel over the waist. In such cases the injury is complicated, and usually with hernia of the abdominal contents into the thorax. This injury can only occur on the left side. Dr. Wilks, in the 'Lancet' for 1858, reported three instances of this diaphragmatic hernia, and pointed out that *excessive thirst* was the most prominent symptom in each. I had the opportunity of seeing these three cases, and others since have come under

notice, in which this symptom of insatiable thirst was most characteristic.

Wounds of the Abdomen, involving Parietes and Viscera.

The parietes of the abdomen are often wounded by sharp substances, whether by accident or design, and so long as the wounds are confined to the parietes the danger is small. When the peritoneum is punctured or perforated the viscera are also probably involved, and under such circumstances the case becomes serious. In rarer instances the intestines protrude, when an additional element of danger is added.

Wounds of the parietes.

Wounds of the parietes alone require the same treatment as wounds of any other part. The surface should be well cleansed, and all foreign bodies removed. Hæmorrhage should be arrested by torsion or ligature, and the edges of the wound brought together with sutures. In deep or lacerated wounds, where the muscles are involved, and the risk of suppuration great, absolute rest in the horizontal position should be enjoined. When suppuration appears the Surgeon must be careful to let out all fluid, either by reopening the wound, or by a fresh opening. *All punctured wounds should be left open;* when bleeding persists the wound should be enlarged and the vessel secured.

Penetrating Wounds of the Parietes.

Penetrating wounds.

There is always a difficulty in diagnosing these cases; that is, in making out the true nature of the accident, more particularly in punctured wounds. When the depth of the wound is known by the extent of insertion of the offending body and the relative position of the viscera at the wounded spot also, some notion as to its nature may be formed; but when no such guide can be found the Surgeon has to rest upon surmise and probabilities. As a rule, where want of evidence is felt, it is well to treat the case as serious. All penetrating wounds are serious, whether incised, lacerated, punctured, or gunshot, but punctured wounds are by far the most common.

Diagnosis difficult as to extent.

Symptoms when viscera injured.

When there is a total absence of all symptoms beyond those of the parietal wound the viscera are probably *uninjured, these negative symptoms affording the best positive evidence of the simple nature of the accident.* When the viscera are *injured* there will generally be more or less lasting syncope or collapse; there will probably be severe local pain, soon becoming radiating; there will also frequently be vomiting, possibly of blood, or the passing of blood from the bowel or bladder. If life is prolonged there will be peritonitis. When the bowel or omentum protrudes, when the fæces, bile, urine, or blood appear at the wound, the evidence is clear. The Surgeon, however, will find much help from collateral evidence in forming an opinion; as, for instance, in the size of the wound compared with the instrument that inflicted it; the position of the blood stain on the instrument; the force with which the blow was struck; the direction of the force in relation to the position of the patient; and the thickness of the abdominal parietes. By these several means an approximate opinion may be formed, but in no case can a positive diagnosis be made with certainty. Under all circumstances, however, the *treatment* must be the same.

Collateral evidence important.

Treatment.

Rest.

Rest.—Absolute rest in the horizontal posture, with the legs flexed to relax the abdominal muscles, is essential; no movement should be allowed, not even for passing the evacuations. With respect to *local treatment,* the greatest simplicity should be employed. The wound

Local treatment.

should be cleansed and all bleeding vessels secured, but anything like an exploration of the wound is to be condemned. All probing, fingering, or manipulating the wound should be avoided as dangerous, and only pertaining to surgical curiosity. The edges of the wound, when it is large, should be brought together by sutures; some simple antiseptic dressings applied, with cold by the metallic coil. Punctured wounds, when perforating, like others, should be left open. Even after the lapse of some days, when no symptoms of wounded viscera appear, the same caution should be observed, two or three weeks being always allowed before freedom is given. Under all circumstances the condition of the *bladder* should be inquired into.

Sutures.

Opium.

Opium in moderate or full doses, according to circumstances, is demanded, to keep the bowels quiet and check peristalsis, it being well to keep a patient under its influence for several days by giving one grain every four or six hours. *Low* diet, that is, milk diet, should be allowed, all food being given cold and in small quantities; ice to suck is refreshing. *Purgatives* should on no account be given till the nature of the case is declared.

Low diet.

Penetrating Wounds with Protruding Viscera.

General remarks.

It is hardly necessary to remark that the special risk of any of these cases is determined greatly by the viscus that is involved, and the amount of injury it has sustained. Thus, a penetrating abdominal wound with protruding omentum is far less dangerous than when hernia of the intestine exists; and a protruding wounded bowel is of graver importance than an uninjured one. It is consequently necessary for the Surgeon in all these cases mentally to run over the position of the viscera, in order that he may form an opinion as to the probabilities of the case. Fig. 253 will refresh his memory on these points.

"Of the hollow viscera any portion of the intestinal canal may be protruded, from the stomach to the sigmoid flexure, according to the situation and degree of distension of the viscera. The small intestines most frequently, next the large, then the stomach, and, lastly, the cæcum. Of the solid viscera the omentum is by far the most common, and is often associated with that of the viscera." (Poland's 'Prize Essay.')

In *small* wounds a limited hernia of the abdominal contents can alone take place, but when it occurs the protruded viscus is very liable to be strangulated. In *large* wounds the hernia will probably be of greater extent, but their constriction is rare.

Protruded omentum.

When omentum protrudes through a *recent* wound, and is uninjured, it should be washed by means of a stream of antiseptic water, and returned with all gentleness, the patient being placed in such a position as to relax the injured muscles. The wound should never be enlarged to allow of the return of omentum. When the omentum has been extruding for some time, and is congested from incarceration or strangulation, when it has become inflamed or perhaps sloughing, it is well not to make any attempt at its reduction. As time goes on and the projecting mass swells and granulates it may be ligatured in halves. This should not be done, however, for at least two weeks after its protrusion. During this time the greatest quiet should be enforced, and moderate doses of opium given with liquid food. After a few days all fear of peritonitis will have passed. Some prefer not to interfere with the protrusion, in the belief that it will wither up sooner or later, but such a process is tedious; the application of a ligature to it in halves

is, moreover, rarely attended with any risk. If the omentum is much bruised or torn at the time of injury, such injured portions may be cut off, and all divided vessels secured.

Fig. 253.

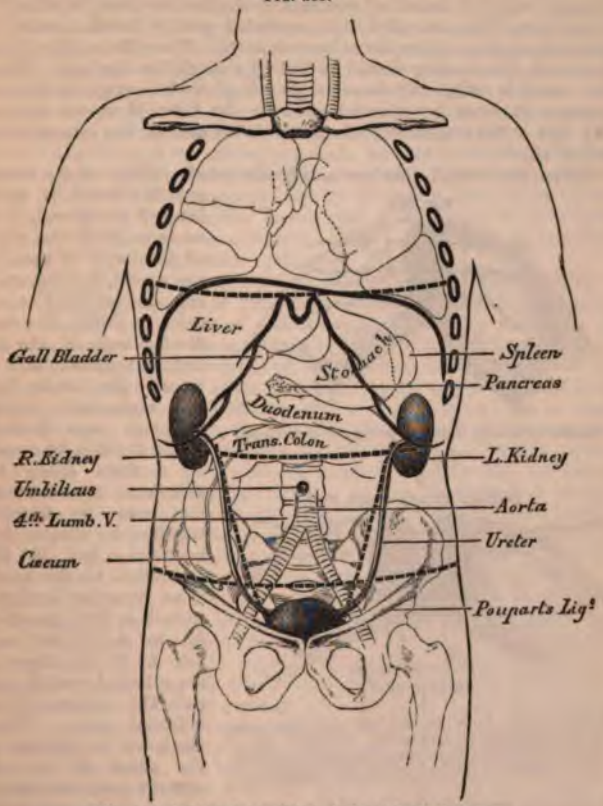


Diagram showing the positions of the abdominal viscera.

Protruded bowel uninjured.

When the bowel protrudes through the wound, and is *uninjured*, it should be cleansed and *returned under all circumstances*, the wound being carefully enlarged for the purpose in the course of the muscular fibres, should its reduction be otherwise impossible. To facilitate this the muscle should be relaxed, and the parts last descended returned first. In returning the intestine the pressure should be directly backwards; if made obliquely the bowel might be pushed up beneath the fascia or muscles, and thus outside the peritoneum. The wound should be closed by sutures, and treated as already described.

When the protruded bowel is *gangrenous* it must be left *in situ* to

slough, and that an artificial anus may form, the wound in the abdominal parietes being enlarged; but where there is any prospect of its recovery, the abdominal cavity is its best place.

Protruded and injured bowel.

When the intestine is wounded, and the opening a mere prick, through which no intestinal contents exude, the bowel may be returned, a few hours being enough for the wounded part to become sealed by plastic exudation, and repair to be completed. When the mucous lining protrudes, the opening should be tied by a single fine ligature. When the wound is sufficiently *large to permit of the escape of the visceral contents* it must be stitched up with the form of suture seen in Fig. 254 or 254A, cleaned, and returned, the ends of the sutures being cut off close.

Wound involving nearly whole calibre.

When the wound *involves nearly the whole calibre of the bowel,* and the bowel is much bruised or injured, it is wiser to stitch the edges of the bowel to those of the wound, thereby making an artificial anus, than to stitch the two divided ends of the intestine together, and to return the whole into the abdominal cavity, although says Pollock if the division be caused by a clean sharp instrument, the extremities may be brought together by sutures and returned; but if the separation be the result of an irregular lacerated wound, as from gunshot, &c., we should not hesitate to fix the edges to the external wound, and risk the chance of an artificial anus. When the bowel is stitched to the edges of the external wound care should be taken to maintain the line of the canal as much as possible and not to draw the intestine more out of its position than is absolutely necessary.

FIG. 254.



Lembert's suture, including peritoneal coat alone.

FIG. 254A.



Double suture. 1. Of mucous and muscular coats. 2. Of serous, as in Lembert's. In distal side of bowel the serous suture should precede the mucous, in proximal the mucous suture should be applied first.

The general and local treatment of all these cases is similar to that already laid down for the treatment of other abdominal and visceral injuries.

Wounded viscera without protrusion

Penetrating abdominal wounds complicated with wounds of the viscera, but without protrusion, are, doubtless, far more serious than any that have been hitherto considered, and their effects depend greatly on the condition of the viscus when wounded. Thus the puncture of a *distended* stomach, intestine, or bladder, will to a certainty be followed by extravasation into the abdominal cavity, and, as a result,

Result.

by great shock and diffuse peritonitis; whereas these organs, when empty, and therefore contracted, may receive a limited injury without any such consequences taking place; *local* inflammation rapidly arising under these circumstances and sealing the wound.

Escape of contents through external wound.

The chief risks of wounds of the viscera when the solid organs become implicated are hæmorrhage, and when the hollow, extravasation. When the contents of the wounded organ escape externally through the wound, the danger of the case is undoubtedly lessened. When the *stomach* is supposed to be wounded by a puncture the utmost care is called for to prevent the administration of any food; indeed *nothing* should enter the stomach for several days, and life should be maintained by nutrient enemata, because to excite any action of the organ would undo what nature may have done for the repair of the injury, and thus jeopardise life by increasing the risk of extravasation. When the *intestine* is *wounded* or suspected to have been wounded, the same care is necessary. When the bladder is wounded it should be drained by lateral cystotomy.

Opium.

Opium should be given, and is best administered by suppositories—the morphia suppositories of the pharmacopœia being the best preparation to employ in all cases of abdominal surgery. The principles of treatment, however, are the same as have been laid down in former pages.

Wound to be left open.

In marked penetrating wounds of the abdomen in which evidence of a wounded hollow viscus exists, the *local wound* as generally advised *should be left open*, or covered only with a loose covering; for to close the wound so as to prevent the escape of the contents of the wounded viscus externally, would be to close the only gate through which return to health is possible. I am, however, disposed to think that the wisest course would be to enlarge the wound, or re-open the abdominal cavity, search for the wounded viscus and sew up the opening in it, subsequently cleansing the abdominal cavity and dealing with the case as described in a former page. The chances of a good result being far greater by this practice under the circumstances than they can be by any other.

Laparotomy.

Case.

Remarkable cases of recovery after impalement are on record, and not the least is that of a boy, æt. 11, who fell upon a rick stake, the stake penetrating his body for seventeen and a half inches. It entered the abdominal cavity in the *right* groin, beneath Poupart's ligament, passed through it to the left side into the thorax, through the diaphragm —displacing the heart and pushing it to the right side of the sternum —into the left lung and passed out of the chest between the seventh and eighth ribs into the axillary space. The stake was removed four hours after its introduction, and not a tea-spoonful of blood was lost. Some intestine which protruded from the wound in the groin was replaced, and the inguinal wound stitched up. Opium, with calomel, was freely given subsequently, and in six weeks the boy was able to sit up, play, and eat his ordinary food. Five months after the accident he was free from pain, and able to walk freely. The case occurred in the practice of Mr. Reynolds, of Thame, Oxon, and is recorded in the 'Med. Times and Gaz.,' Sept. 23, 1871.

Abnormal Anus, Fæcal Fistula.

Fæcal fistula.

Confining the term "*artificial anus*" to the surgical operation of forming an anus otherwise than natural for the relief of intestinal obstruction, whether by colotomy or enterotomy, an "abnormal anus,"

or intestinal fistula—*fæcal fistula*—or an unnatural communication between the intestinal canal and the outside of the body, is generally the result of sloughing or ulcerating bowel, in strangulated hernia; although it may occur, either from a wound to the intestine from some external cause, or, from a perforation of the intestine from an ulcerating process originating from within.

When it follows a hernia, the opening is usually at the neck of the hernial sac; when it follows a wound, at the seat of injury; when it is the result of some ulcerative process originating from within, the fæcal abscess may burrow into the pelvis (opening into the vagina, bladder, or even bowel again), or between the abdominal muscles, and make its appearance in the groin, iliac fossa, or loin. When the opening is *large* and *direct* into the bowel it has been called "artificial anus;" when small, indirect, or fistulous, "fæcal or intestinal fistula."

When wound small.

The most important point, however, connected with this subject has reference to the amount of intestine involved. When only a small portion of its calibre has been lost, the fistula generally will be small; when a large portion of its calibre or a whole knuckle has been involved, the fæcal orifice will be large. Under these circumstances the two orifices communicating with the upper and lower ends of the bowel respectively can generally be made out, a fold of membrane formed by the junction of the bent tube standing as a partition between the two portions of the gut. At times, this partition will project so far forward as to close completely the orifice of the lower part of the bowel, and this is the usual state of affairs when a complete knuckle of bowel has been involved in the disease, and under these circumstances a cure by natural processes is almost impossible. At other times the partition will be but limited, and a portion only of the contents of the bowel will pass externally, the other portion taking its normal course downwards towards the anus, when it is more than probable that nature alone, or but slightly assisted by art, will effect a cure. When the orifice is large, there is almost always some prolapse of the bowel. Under all these conditions, the intestines within the abdomen are closely connected by means of adhesions to the external orifice; the serous surface of the intestine becoming firmly fixed to that of the opening in the abdominal parietes. Beyond these adhesions it is rare to find other coils of intestine adherent about the part; on the contrary, the parts are otherwise usually so free that coils of bowel will be found separating the two portions of intestine that are adherent at the wound, and may so dip down between them as to push forward a serous sac into the artificial opening, and even to form a hernia. The nature of the discharging fluid will fairly indicate the portion of the bowel involved; when well-formed fæces pass, the large or lower part of the small intestine is probably the seat; when the fluid is thin and inoffensive the jejunum is indicated. The yellow semi-fæculent contents of the ileum can generally be recognised. The nearer the opening is to the stomach the worse is the prognosis, as nutrition under such circumstances must be seriously interfered with. The nearer it is to the lower end of the canal, the better are the prospects of life.

When wound is large. Position between the two ends.

Prolapse of bowel.

Discharge from bowel a means of diagnosis.

Prognosis.

Treatment.

TREATMENT.—When the orifice is fistulous and the canal below the fistula is fairly open for the passage of fæces, a cure may with some certainty be looked for by natural processes, and such a result is by no

means unusual in the artificial anus, which is met with, *after the return of a small hernia into the abdomen*, and particularly of a femoral hernia. In these cases the Surgeon has little more to do than to keep up the strength, give simple nutritious diet, maintain perfect cleanliness of the wound, and apply gentle pressure to the part. When the fistulous communication is larger, the same treatment must be employed, though with less hope of success. Lawrence recommended the constant use of a truss in these cases to prevent prolapsus, and Pollock strongly advocates the importance of the recommendation, adding that "a compress of linen placed on the opening, with a larger pad over it, and a truss applied over the whole, will, in a great measure restrain the contents as well as prevent the protrusion of the bowel." To assist the contraction of small fistulæ, the edges may be cauterised, or even pared, a plastic operation being justifiable under certain circumstances.

Palliative.

Use of truss.

With respect to surgical interference in these cases, the recommendations I have to offer are not very satisfactory. Dupuytren suggested an operation to get rid of the projecting fold or septum that has been described. He did this by an instrument called an enterotome, a pair of forceps with one blade grooved, into which the other closed, the approximation of the blades being regulated by a screw. The septum was crushed between the blades, and so held till its destruction was effected. The instrument, as a rule, came away about the seventh day, and, Dupuytren says, "by the division and loss of substance, the ridge and the double septum which separate the two ends of the bowel are destroyed, so as to re-establish the interrupted communication between them, and restore the natural course of the aliment and fæces." Jobert advises the pressure of the instrument to be gradual, fatal cases having occurred when Dupuytren's rapid process has been employed. The theory of this operation is good; and is based on nature's own processes; for I have seen the septum of an artificial anus ulcerated through by natural processes, leaving an opening through which fæces passed from the upper to the lower bowel, a narrow band above, alone existing to prevent a freer fæculent flow. The success of the operation has also been good; inasmuch as out of forty-one operations recorded by Dupuytren twenty-nine recovered, nine were relieved, and three died. In this country the operation has been little practised. Dr. Buchanan, of Glasgow, however, has recorded a successful case. ('Edin. Med. Jour.,' 1869.)

Surgical interference.

Dupuytren's operation. 'Mém. de l'Acad. de Méd.,' 1828.

Success of operation.

When a *fæcal abscess* has formed in the abdominal walls the sooner it is opened the better, and, when opened, the incision should be free. In abscesses connected with the *cæcum* or its *appendage*, this rule is important, and, if acted upon, good results may be anticipated. For intestinal fistula opening directly into the *vagina* little can be done surgically beyond attending to the general condition of the patient, giving nutritious food, though not such as is likely to distend the bowel, and observing perfect cleanliness of the passage. The external opening should be enlarged, however, if anything like retained pus exist. Under these circumstances a natural recovery may take place. In recto-vaginal fistulæ plastic operations are most successful.

When fæcal abscess formed.

When the *bowel* has ulcerated into the bladder natural processes appear to be rarely capable of effecting a cure, and, under such circumstances, to save the patient from the miseries caused by the passage of solid fæces into the bladder, the operation of colotomy may be exter-

When bowel ulcerated into bladder.

tained. I have performed this operation on many occasions under these circumstances with success, the operation in all giving great relief. One of my patients is now (1884) alive, free from all pain, the operation having been performed on July 5th, 1870 ('Clin. Soc.,' 1872). In another case, operated upon on August 16th, 1869, the gentleman lived to March, 1875, and died from heart disease at the age of 70. The third died from some kidney affection some months after the operation ('Med.-Chir. Rev.,' 1869). The others died some weeks after from the cancerous affection for which the operation was demanded, but free from all pain.

Colotomy as treatment.

Foreign Bodies in the Stomach and Intestines.

Foreign bodies in the stomach and intestines.

Foreign bodies are often taken into the stomach from accident and design, and the records of cases prove that from the absence or mildness of symptoms, no Surgeon should pronounce against the possibility of their introduction. They are passed as often as not per anum without giving rise to very distressing symptoms, although when retained they cause nothing but evil. *Smooth hard bodies*, such as coins and stones, as a rule, pass readily without giving rise to any or other than slight colicky symptoms, but *sharp* and *pointed bodies*, such as bones, pins, knives, metallic plates with teeth, &c., give rise to such as vary according to the position of the intestines at which they become impacted.

May be ejected by vomiting.

A foreign body taken into the stomach may be ejected by vomiting, discharged externally through the abdominal parietes, retained in the stomach, or passed onwards. In Fig. 255 is illustrated a piece of iron

Fig. 255.



Piece of iron wire discharged from abscess in abdominal walls after having been swallowed. Natural size.

Discharged externally.

wire that was swallowed by a female lunatic, æt. 56, on March 10th, 1873. The symptoms that followed were so slight, that some doubts as to the occurrence existed, and it was not till May 15th, two months later, when a swelling was detected in the right of the umbilicus that the history was credited. The swelling rapidly increased, and opened on May 20th, and the point of the iron wire projected. This was withdrawn by Dr. T. B. Dyer, the Surgeon of Colney Hatch, and a rapid recovery followed, no single bad symptom making its appearance. My friend Mr. Lund, of Manchester, has likewise recorded a similar case in the 'Liverpool and Manchester Med.-Surg. Reports' for 1873. When retained, a foreign body may rest without giving rise to very serious symptoms—a rare result—or set up ulceration which may in its turn give rise to a fatal peritonitis. In the more fortunate it will be passed on through the canal and discharged.

To prove these points I may record the case of a man, æt. 22, who came under my care in 1882, two days after having swallowed, in the night, an artificial metal plate, two inches long by one wide, with three incisor teeth, and metal hooks to catch the right two and left first bicuspid teeth (Fig. 255a). He passed the plate per anum, without

pain, on the eighth day, and restored them to their original position, in no way injured by their passage. The reader may also refer to Mr. Pollock's article in 'Holmes's System,' vol. i, where he gives a case in which a lady vomited a gold plate three quarters of an inch long, with two false teeth, after it had been lodged in the œsophagus for nineteen and in the stomach for ninety-seven days. A case is likewise on record in which a lady passed per anum a plate two and a quarter inches in diameter with four teeth six months after she had swallowed it. May pass per anum.

A remarkable case of this kind has been recently recorded in the 'Thirtieth Report of the Commissioners in Lunacy,' 1876. A woman, æt. 43 (having made previously many suicidal attempts), on July 31st, 1875, swallowed thirteen screws, each screw consisting of a body 2½ inches long and ⅛ inch thick, a raised collar nearly ⅜ inch in diameter, and a square head; the whole thirteen screws weighing 24 ounces. She was fed on pudding and gruel, morphia was injected subcutaneously to relieve pain, and after a few days ounce doses of castor oil were given daily. On the forty-first day the first of the screws passed by the bowel, and by the end of the sixth month the last came away. The screws in their passage had lost 4¾ ounces in weight. This case occurred in the Bristol Asylum under the care of Dr. Thompson. Poland has also recorded in his prize essay the case of a lunatic who died from ulceration of the duodenum owing to the pressure of a spoon handle that had been swallowed about three months before, with *thirty* others, besides nails, pebbles, and pieces of iron. These foreign bodies were extracted from the stomach after death, and weighed in all forty ounces. The most complete list of cases of foreign bodies in the digestive canal will be found in the 'Union Médicale' for November, 1874, by Dr. Mignon.

FIG. 255A.



Plate with teeth passed per anum on eighth day.

In Guy's Museum (Prep. 1800) there is an enlarged and thickened stomach of a sailor, who had swallowed clasp knives. He was æt. 23, and in June, 1799, he swallowed four clasp knives, which were discharged from the bowels. In March, 1805, he swallowed from fifteen to twenty more, after which his health became impaired. He vomited the handle of one and passed portions of the blades of others, and in March, 1809, died in a state of exhaustion. After death one blade was found perforating the colon opposite the kidneys, but without extravasation of fæces, and another was fixed across the rectum. In the stomach, too, were numerous blades partially dissolved, or between thirty and forty fragments in all. May be retained.

At times, intestinal calculi form from the agglomeration of hair, husk, particularly oat husks, or other foreign substances, and prove fatal. Dr. Down has recorded such a case, in a boy, æt. 13, who died of exhaustion after fifteen days' illness. Not many years ago I saw an Concretions. 'Path. Trans.,' 1867.

artist, æt. 36, who died from intestinal obstruction, through whose abdominal walls a globular indurated mass was readily felt on the right of the umbilicus. I suspected it to be made up of hair, for he was in the habit of sucking to an excess the paint brushes of his pupils, but the diagnosis could not be verified after death.

Treatment.

TREATMENT.—Rest in the horizontal position and expectant treatment are in these cases the two essential points to be observed. Purgatives should on no account be given. The "smasher," according to Pollock, who constantly swallows false coin, when caught in the act of passing it, avoids *purgatives*, but takes a constipating diet, such as hard-boiled eggs and cheese, together with his usual food, thinking that the money is more likely to be caught, and consequently passed in a bulky stool than in a liquid one. The Surgeon should act on this principle. When the foreign body becomes impacted in the stomach or intestine, or sets up inflammatory action and peritonitis, the abdomen should be opened and the foreign body removed by *gastrotomy*, ten cases out of eleven in which this operation has been performed having recovered. (*Vide* paper by Dr. Pooley, of New York, 'Richmond Med. Journ.,' April, 1875.)

Gastrotomy and Gastrostomy.

Gastrotomy and gastrostomy.

When the stomach has to be opened for the removal of a foreign body the operation is rightly described as that of "gastrotomy." When the same operation is performed with a view to establish a permanent fistula for the introduction of food, as first performed by Sédillot in 1849, and described by him as gastro-stomie, the term "gastrostomy," as suggested by Dr. Pooley, seems to be the more applicable term.

That the operation of "*gastrotomy*" is not necessarily fatal is proved by the fact that it has been performed at least eleven times, and in ten with success, and though in the fifty or sixty cases in which "*gastrostomy*" has been undertaken for *cancer*, life has never been prolonged for more than six months (my own case, 'Lancet,' May 6th, 1882); the relief it has afforded to those who have been subjected to it is sufficient to prove that it is based upon a sound principle and a humane practice, the operation having been undertaken more with a view of mitigating the horrors of a death from hunger and thirst, and of prolonging what remained of life than from any curative object. I have had an opportunity of watching the progress of some of the early cases under the care of my colleagues, Messrs. Cooper Forster and Durham, of many under my own care, and some under the care of other colleagues; and I am free to acknowledge that the advantages given by the operation are worth the risk, and that if life were not prolonged, it was certainly rendered more endurable.

When the operation is performed for a cicatricial stricture, better results may be recorded, for out of eleven cases reported eight recovered. The interesting cases, operated upon at Rostock by Dr. Trendelenburg, March 8th, 1876 (Med. Record,' March, 1878); in Paris by M. Verneuil (Gaz. des Hôp.,' Oct. 28th, 1876; 'Lancet,' Jan. 13th, 1877), and of my own case, 'Lancet,' April 8, 1881, support this view.

Trendelenburg's case for cicatricial stricture.

Trendelenburg's case was in a lad who had swallowed some sulphuric acid six months previously, and the stricture was in the lower end of the gullet. At the end of the fifth month after the operation the weight of the boy's body had increased by one fourth. The boy took

food as usual by the mouth, masticated it, and then blew the contents of his mouth through a long elastic tube directly from the mouth into the cavity of the stomach. Mode of feeding.

Verneuil's patient was a mason, æt. 17, and the stricture a cicatricial one, due to the accidental swallowing of some caustic potash on February 4th, 1876. Œsophagotomy was out of the question, as the stricture was situated low down in the tube, and relief was called for because swallowing was impossible. On June 26th, gastrostomy consequently was performed, and a rapid recovery followed. The man was up and about on August 20th. A caoutchouc sound was kept in the wound for feeding purposes. In the report of the case it is stated that when food is poured into the stomach the only sensation experienced is that of heat or cold. Saliva, however, is at the time freely secreted, and the man executes masticatory movements. Digestion goes on well without the aid of saliva. Verneuil's case.

My own case was a girl æt. 22, who, seven months before her admission into Guy's in July, 1880, had swallowed a wineglassful of sulphuric acid. The œsophagus was almost completely closed and no bougie could be passed. A rapid recovery followed the operation, and the opening into stomach was very small. The patient is now well, but unable to swallow anything. The opening into the stomach is hardly visible and the parts around it are quite dry. She can feed herself when standing and no regurgitation of food or fluid takes place. Author's case.

These cases are most satisfactory, and are sufficient to encourage the belief that better success would follow this operation, even when undertaken for cancer, if it were performed at an earlier period of the disease than has hitherto been the practice.

We perform colotomy on a patient with cancerous stricture of the intestine or other mechanical obstruction without hesitation, and surgeons are now willing to admit the great advantages afforded by this means. Surely the advantages offered by "gastrostomy" for stricture of the œsophagus, cancerous or otherwise, are not less potent, and *should it be undertaken before the patient's powers have been brought to too low an ebb*, there is no reason why it should not be equally effective. In one of my own cases performed for cancer the man lived five days, and the operation had nothing to do with the death, there being no peritonitis, and the local repair was most complete. In the second case the patient lived two days; in the third, fifty-one days; in the fourth, six months. So also was colotomy unsuccessful till it was undertaken at an earlier stage of the disease. Gastrostomy, as a rule, has been put off until too late; it has, however, now become an established operation in surgery. Arguments in favour.

The Operation.—An anæsthetic should be given, although the risks of vomiting as a consequence are not slight. The patient should be placed upon his back, and an incision made parallel with and half-an-inch below the margin of the left ribs. The cut should be from three to four inches in length and its centre should correspond with the line of the linea semilunaris; the tissues should be divided seriatim down to the peritoneum. Every vessel should be twisted or tied as it bleeds, and all capillary oozing arrested by a large sponge. The peritoneum may then be divided and the stomach sought. In the cases I have operated upon it was seized readily. If the liver presents it should be raised, and if the omentum comes into view it should be Description of the operation. Oblique incision recommended.

drawn downwards. The colon should not be mistaken for the stomach. When the stomach is found, it should be held well forwards against the abdominal parietes with a pair of tenaculum pointed forceps and two loops of fine silk introduced one third of an inch apart by means of a delicate curved needle through the peritoneal and muscular coats of the viscus. The ends of these loops should be left long for a purpose to be described later on. The stomach may then be carefully secured to the margin of the wound by means of a sufficient number of silk sutures; the sutures should be made to include the peritoneal and muscular coats of the stomach, and the parietal layer of peritoneum and muscles. Some Surgeons introduce a double row of sutures, but I do not believe this step is necessary.

The first half of the operation is now completed.

Second part of operation.

The second half is really the completion of the operation, for it includes the opening of the stomach, and this should be carried out on the 5th or 6th day after the first step, and is effected with ease and without pain by simply holding the stomach forward by means of the two loops of ligatures which were introduced into its walls when first caught, and puncturing the exposed area with a tenotomy knife.

Small opening into stomach.

The opening into the stomach need not be larger than one eighth of an inch. The silk loops may now be removed. By this small puncture the Surgeon gains all he can desire; for the walls of the stomach being elastic, the small opening readily yields to the slightest pressure, so that a tube the size of a No. 10 catheter can readily be introduced into the stomach for feeding purposes, and by virtue of this same elasticity, when the tube is withdrawn, the artificial orifice closes, and as a result there is little or no escape of the contents of the stomach to saturate the patient's linen or to irritate the soft parts around the artificial orifice, and thus add to the patient's discomfort. In the case recorded above the wound is now, as it has been since 1880, quite dry.

For feeding purposes after the first few days have passed, and during which warm milk with eggs is the best diet, the food should be thick, and for its easy introduction, Messrs. Krohne, of 8, Duke Street, Manchester Square, have made for me an apparatus which consists of a small Higginson's syringe, with a small tube at one end to be introduced into the stomach, and a larger one in the other connected with a glass funnel as a receptacle for food. With this, thick food such as peptonised meat, can easily be thrown into the stomach.

It must be added that Sédillot was the first person to perform the operation in 1849, and Mr. Cooper Forster, on the suggestion of Dr. Habershon, was the first to do it in this country in 1857. Since then it has been repeated about fifty or sixty times.

Conclusion.

By way of conclusion. Gastrostomy should be undertaken for cancerous or cicatricial stricture of the œsophagus, as soon as there is practical difficulty in the introduction of solid food into the stomach, life being prolonged, and much misery saved, by such a practice when the disease is cancerous, and life being saved indefinitely when the cause is traumatic.

When the ulceration is not cancerous, but simple or syphilitic, a cure may be looked for, my colleague, Mr. Davies-Colley, having now a patient alive for whom he performed gastrostomy some years ago to save her life from starvation, and nine months later closed the fistula, the ulceration having healed, and the power of swallowing having been restored.

The operation should, when practicable, be divided into two steps, as suggested by Mr. Howse, and his improvement being so great, it should be described as Howse's operation.

The opening into the stomach should not be larger than that made by an ordinary tenotomy knife, or about one eighth of an inch.

Intestinal Obstruction.

In cases of acute or chronic intestinal obstruction, when the physician's art has failed to give relief, the Surgeon's aid is required, and it would be well for the medical mind to recognise the fact that, in a large proportion of instances, this aid is sought at too late a period—that is, when the patient's powers have become so exhausted as to exclude all hope of a successful issue being obtained by any treatment, or when the involved tissues have undergone such changes from peritoneal complications as to forbid any reasonable expectation of the competency of nature's reparative powers to effect a cure, even where the cause of the obstruction has been removed. Mischief of delay.

It should ever be remembered that cases of *acute* intestinal obstruction, like those of strangulated hernia, require prompt and active treatment if they are to be successful; and that those of *chronic* obstruction require a no less decided line of action. It must be admitted, also, that there is no class of cases which claim for diagnostic purposes more thought and judgment; that the difficulties of diagnosis as to the cause of the obstruction are sometimes great; and that the question of operative relief has to be decided consequently upon uncertain grounds. But such arguments, to my mind, are in favour of operative measures for diagnostic as much as for curative purposes, and in no way tell against them when the diagnosis is clear. Difficulty of diagnosis.

When the diagnosis is clear and the nature of the case decided, delay is dangerous, and a want of courage to act upon the diagnosis in the Surgeon is criminal. The question of diagnosis is consequently all important, and will first claim attention.

Diagnosis.—In a clinical point of view cases of intestinal obstruction may be divided into "*acute*" and "*chronic.*" The "*acute*" include strangulation of a portion of bowel from external or internal hernia, omental, mesenteric, peritoneal, or fœtal bands, or twists of the intestine (volvulus). The "*chronic*" embrace: inflammatory, syphilitic, or cancerous strictures of the large or small intestine; the occlusion of the bowel from the mechanical pressure of tumours; adhesions of the intestines from inflammatory peritoneal changes; and last, but not least, the impaction of fæces.

Perityphlitis, the passage of a gall-stone, and acute peritonitis due to perforation, may simulate acute obstruction. Intussusception belongs to both divisions, since when the invaginated portion of bowel is acutely strangulated acute symptoms will show themselves, and when the same portion is incarcerated, the symptoms will be chronic; although in their onset they may be sudden. The relative frequency of these conditions will be seen in the following table:

In all cases of intestinal obstruction the diagnosis should be made upon the principle of exclusion, the practitioner coming to a conclusion by first running over every possible cause, and eliminating each seriatim, and subsequently weighing the points in favour of the probable cause.

CAUSES OF INTESTINAL OBSTRUCTION, EXCLUDING HERNIA.

Being an analysis of 124 consecutive cases extracted from the post-mortem records of Guy's Hospital, by Dr. Hilton Fagge, from 1854 to 1868 ('Guy's Rep.,' 1868); and Mr. Russell, from 1868 to 1876 (unpublished).

Guy's Cases.						
33	Acute obstruction	1 Internal hernia.				
		7 Twists (volvulus).				
		25 Bands	14 Lymph.			
			6 Diverticula.			
			2 Appendix cæci.			
			2 to neck of hernial sac.			
			1 from pedicle of ovarian tumour.			
76	Chronic obstruction	3 Fæcal impaction.				
		3 Mechanical pressure of tumours.				
		47 Stricture	2 Small intestine.			
			45 Large	33 Rectum and sigmoid flexure		
				7 Transverse colon with hepatic and splenic flexures		
				5 Cæcum or ileo-cæcal		
		23 Matting together of intestinal coils from peritoneal and cancerous disease. (Contractions.)				
15	Intussusceptions	2 Rectal.				
		7 Ileo-cæcal.				
		6 Small intestine.				
124						

Analysis of 63 cases of Stricture of Intestines as given in a Paper by Coupland and Morris ('Brit. Med. Journ.,' Jan. 26, 1878).

	Middlesex Cases. 28 Large Intestines, 3 Small.	Pathological Society. 31 Large Intestines, 1 small.	General Total.
Rectum and sigmoid flexure	24	21	= 78
Transverse colon with hepatic and splenic flexures	3	9	= 19
Cæcum or ileo-cæcal	1	1	= 7
			104

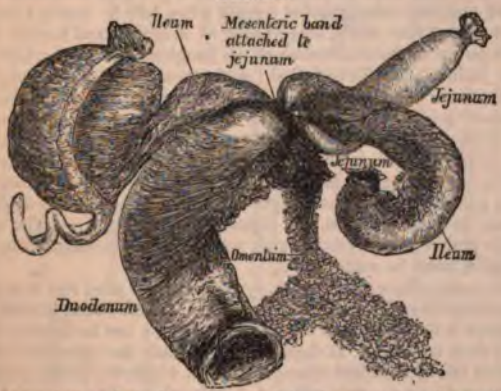
The possibility of the symptoms being due to a strangulated or incarcerated external hernia should always be carefully investigated. Always look for hernia.

Acute Internal Strangulation of the Bowel,

whether from an internal hernia, twist (volvulus), or a fœtal or peritoneal lymph band, may take place at any period of life, and the symptoms to which it gives rise are those of an acute strangulated external hernia, viz. sudden and definite onset of the illness in a healthy subject, severe paroxysmal central abdominal pain, attended by sickness and more or less collapse; constipation, inability to pass wind downwards, and hiccough; occasionally also scanty urine, or even its suppression; coils of distended bowel are sometimes visible through the parietes. Symptoms of acute obstruction.

There will, however, be no distinct abdominal tumour, no tenesmus, and no hæmorrhage from the bowel, such as is often present in an acute intussusception. There may, however, be some evidence of one coil of intestine being more tense or distended than another.

FIG. 256.



Case of strangulation of the bowel by lymph-band constricting ileum about three inches from cæcum and a coil of jejunum. Taken from a man, æt. 26, who died after bowel obstruction of 15 days' duration. This case occurred in my father's practice in 1838, and is recorded in 'Trans. Med. Soc. of London,' 1846. The suggestion was then made of operative interference.

When, therefore, a case presents itself with these symptoms there can be no difficulty in coming to a conclusion as to its nature, although it may be difficult, if not impossible, to diagnose the precise cause of the strangulation. If, however, we refer to the table at page 708, some guide will be found, for it will there be seen that out of 33 cases 25 were due to bands, 7 to volvulus, and 1 to internal hernia. Examples.

When there has been a history of old hernia the probabilities of the existence of a band are much enhanced, since it is true that with hernia such bands are not uncommon. Duchaussoy, in his paper "On Internal Strangulation" ('Mém. de l'Acad. de Méd.,' 1860), gives such cases. Fagge quotes one, and in my own practice four have occurred; one died unrelieved; in the second I opened the empty hernial sac, and so

enlarged my incision upwards for about two inches as to detect a b high up in the abdomen, which I divided with a pair of scissors, an perfect recovery took place. This case occurred in the practice of Wilkinson, of Sydenham, and is fully recorded in the 'Med.-C Trans.' for 1867. The patient is still alive. The third and fourth d after the operation, but the band was divided, and a large coil of in tine released. The operations had been delayed too long.

Analysis of 148 cases.

Mr. Gay's analysis of 148 cases tells us that 102 were in the m and 46 in the female, and that the largest number of cases took pl in patients between 15 and 35.

Argument for operation.

The Surgeon, under the circumstances related, however, has a cl case and an important decision before him, for if the diagnosis correct, and a portion of bowel is *strangulated* within the abdom obstructed by some solitary band or twisted, he knows that very li can be looked for by medical treatment—that by leaving things al and the case is unrelieved, death is inevitable; and he is aware, m over, that the hope of a cure by natural processes is very meagre; if I estimate that hope as being nearly on a par with that entertain a case of ordinary strangulated hernia when left to itself, I shall p bably be about the mark, since cases of strangulated hernia do oc *sionally* go up of themselves when all surgical efforts short of her tomy to reduce them have failed; and cases of internal strangulati from whatever cause, do *occasionally* free themselves. Neverthel no prudent mind, on the strength of these exceptional occurren would willingly leave a case of external strangulated hernia to its and I think that no prudent Surgeon ought to leave unrelieved a case of internal hernia or strangulation to the same almost forlorn ho because, granting that the diagnosis of the case can be made, by medicine, no manipulation, no expectant treatment can the mech ical obstruction be overcome, and, under these circumstances, a fa termination must be anticipated.

Opium.

Opium may relieve pain, mask symptoms, and give rise to a plea delusion that all is doing well in cases of internal strangulation, as i well known it does in others of external hernia; but in the one, as in other, it does no more. It does not accomplish the only true remedy viz. relieve the mechanical strangulation to which the bowel is subject

Treatment of external and internal hernia compared.

In *external* acute strangulated hernia, the only recognised cou treatment when the hernia cannot be reduced is herniotomy; a when the hernial tumour does not seem to be the seat of strang lation, and symptoms of strangulation exist, the Surgeon regards exploratory operation at the seat of hernia for purposes of diagn not only a justifiable, but a called-for measure.

In *internal* hernia, or in any case of acute strangulation fr whatever cause, I maintain that a like principle of practice sho be acted upon; for when the diagnosis is sure, it is by "laparotom alone that a cure can be brought about; and when it is uncerta it is by "laparotomy" alone that the diagnosis can be made out, a a correct line of treatment adopted.

The operation of ovariotomy has proved to us that the exposure a manipulation of healthy intestine is not of itself a fatal measure, a there is every reason to believe that in the cases now under conside tion a good result might often be secured if the operations were pe formed before a fatal peritonitis had set in or the strangulated bow

A HELP TO DIAGNOSIS IN CASES OF ABDOMINAL OBSTRUCTION.

"Let no one set too much value on any one sign or symptom."—FAGGE.

	Acute—	Chronic Obstruction.		Acute or Chronic—
	Obstruction or Strangulation.	**From Disease of Large Intestine.**	**From Disease of Small Intestine.**	**Intussusception.**
Previous condition of subject	In good health	Ailing for some time with abdominal symptoms.	Ailing, with previous attacks of incomplete obstruction.	In good health.
Mode of attack . . .	Very sudden and acute . .	Symptoms gradually increasing in severity, or acute grafted upon chronic.	Paroxysms of colicky pain, upon old symptoms.	Sudden onset, and increasing when acute, subsiding when chronic.
Early symptoms—				
Pain	*Abdominal Pain*—fixed, central, and paroxysmal.	*Pain*—diffused and increasing with distension.	*Pain*—Paroxysmal, with intervals of ease in hypogastric situation.	*Pain*—fixed and often relieved by pressure.
Vomiting	*Vomiting*—rapidly becoming fæcal	Intermittent and fæcal towards the last.	Occasional during attack of pain.	Rapidly becoming fæcal in acute cases, absent or intermittent in chronic.
Collapse	*Collapse*—very marked . .	Absent till the end	Absent till late	Very marked in acute cases, not so in chronic.
Constipation . . .	Absolute constipation and inability to pass flatus.	Gradually increasing in severity.	Attacks of constipation, alternating with natural relief.	Occasionally present, but as a rule "dysenteric" symptoms, straining, tenesmus, muco-sanguineous stools, or hæmorrhage.
Abdominal distension .	Rapid and severe, central and hypogastric.	Gradually increasing, lumbar and epigastric.	Never great, increased during attack.	Rarely severe.
Manipular indications .	Tympanitic, distended coils at times to be felt.	A fixed swelling at times to be felt in either iliac fossa.	A doughy condition of bowel, becoming knotty during attack.	Distinct tumour often to be felt, its shape varying during attack.
Visible indications . .	Abdomen tense in umbilical and hypogastric regions, with visibly distended coils.	Abdomen broadly distended, coils of intestine visible.	Coils of intestine, very visible.	Nothing marked to be seen.
Peristalsis	Rarely visible	Marked	Very marked	Not visible.
Urine	Scanty or suppressed . . .	Natural in quantity	Natural	Natural.
Rectal examination . .	Lower bowel probably quite empty.	Stricture of bowel may be felt in rectum or in sigmoid flexure by manual examination.	Nothing abnormal	Rectum may contain mucus, blood clot or invaginated bowel.

been injured past recovery. At any rate, as matters now stand, a recovery by medical treatment from an internal strangulation is a matter of wonder, and it would be well, as all collateral experience indicates, that a bolder practice should be employed.

Operation supported by pathological facts.

If we appeal to pathology, and it is only there unfortunately that we can appeal, we receive ample facts, since the late Dr. Fagge, in his able article already referred to, tells us that "there might in many cases have been no little difficulty in finding a band among the distended coils, but I regard the facts derivable from our post-mortem records as indicating no insurmountable obstacles to the success of an exploratory operation in the great majority of the cases of true internal strangulation, which are to be found in these records." Dr. Brinton, in his analysis of 600 cases, points also to the same conclusions. Under these circumstances, I feel bound to express my conviction that, on the diagnosis being made of an internal strangulation, from whatever cause, the operation of "laparotomy" should be performed, and that on the diagnosis of the cause being uncertain, laparotomy is likewise called for to clear up doubts, and to deal with conditions which are otherwise irremediable. But this operation is not to be performed as a "dernier ressort" more than that for external hernia; but should be carried out as early in the progress of the case as the diagnosis will justify—when, in spite of the gravity of the measure, good results may be looked for.

Chronic Intestinal Obstruction

now claims attention, and it is to be observed "in limine" that the clinical history of these cases is very distinct from that of the acute; for whereas in the "acute" the symptoms appear, as a rule, suddenly in patients who have been apparently in good health—in the "chronic" it will almost always be found that there has been for a more or less lengthened period some abdominal pain or symptom; some difficulty in obtaining a movement of the bowels, or in the act of defæcation—some discharge, probably, of glairy mucus, of pus, or of blood, separately or combined, at uncertain intervals; and last, but not least, some change in the form and character of the stools, the motions at one time being liquid and loose, at another hard and marble-like, while at intervals they are pipe or tape-like. Under all circumstances there will be symptoms of long standing, and, if acute symptoms exist when the case comes under notice, they will be found to have been grafted upon the old. If, therefore, we are called to see a patient suffering from marked symptoms of obstruction of some days' duration, and obtain such a history of the case as has just been sketched, and find him with abdominal tympanitic distension, and probably pain, possibly visible peristalsis, nausea, vomiting, hiccough, and borborygmi, we may safely come to the conclusion that the case is one of chronic obstruction, and that it has for its cause one of those named in the table (page 708). It will prove to be either stricture of the colon or rectum, the mechanical pressure of a pelvic or abdominal tumour, the matting together of the intestinal coils from old or chronic inflammation of the peritoneum or mesentery, or from cancerous abscess; and last but not least, to fæcal accumulations, and in every case of obstruction the last possibility being the cause should be borne in mind. Rare instances are also on record in which other causes have existed; and I have given in the chapter on hernia, some in which the obstruction had been clearly

Symptoms acute upon chronic.

traced to the influence of an adhesion between the bowel and a hernial sac, or some part of the abdominal parietes, or to an obstructed obturator or other hernia.

The effects of obstruction, from whatever cause, are very uniform, and every case will terminate fatally from either exhaustion or peritonitis, if the obstruction is not overcome; when chronic peritonitis occurs it is due to the obstruction, and when the peritonitis is acute it is due to either a perforating ulcer of the sigmoid flexure secondary to the stricture; to some ulceration of the cæcum or colon, the result of overdistension; or to the mechanical rupture of the cæcum, the direct result of the pressure of the fæcal accumulation acting backwards upon the cæcal cul-de-sac. My notes describe two cases in which the cæcum burst; one in which it was purple in colour, and measured fifteen inches round; and another in which it had sloughed. I have also notes of a case of a male child born with an imperforate rectum, who died on the sixth day from ruptured cæcum. And out of eleven consecutive fatal cases of untreated stricture of the rectum at Guy's Hospital, collected by my dresser, Mr. Russell, death was caused by ruptured cæcum in three, by perforation of the sigmoid flexure in two, by peritonitis after puncture to relieve flatus in one, and by exhaustion in three. Hence the importance of early relief before these changes have been started. These points have been ably brought out in Coupland and Morris's paper. Ruptured cæcum.

To diagnose the true cause of the obstruction is therefore the Surgeon's next aim, and it would be well if I were able to add that the task is an easy one; but such is not the case. It is true when the obstruction is in the rectum that a digital examination of the part may find it out; when in the sigmoid flexure that the cautious introduction of the whole hand into the rectum (after the method of Simon, of Heidelberg) may detect it, and that when a tumour is to be felt by palpation to the left of the umbilicus, through the abdominal walls, the probability is suggested of the disease being in the colon, but without these guides little definite knowledge is to be obtained by either palpation or percussion; by the passage of the long tube, or by the amount of fluid that may be injected into the colon. Diagnosis.

Under these circumstances, therefore, the Surgeon is thrown back upon the probabilities of the case, as read by the light of pathological knowledge, and it is gratifying to be able to show that these facts speak with no uncertain sound. Indeed, they speak so strongly and decidedly that the Surgeon may rely upon them with confidence, and base his practice upon their indications.

The facts are revealed in the table to which I have already drawn attention. There it will be seen that out of the 76 fatal cases of chronic obstruction, 3 were due to fæcal impaction, 3 to the mechanical pressure of tumours, 23 to what Dr. Fagge described as "contraction," caused by the matting together of the intestinal coils from peritoneal or cancerous disease, and 47 to strictures of the bowel.

Now, cases of fæcal accumulation do not require any lengthened treatment in these pages; when they come under the Surgeon's care as examples of obstruction, they are to be treated by the mechanical removal of the fæces from the rectum by such means as the finger, the lithotomy scoop, or the handle of an iron spoon—these measures being aided materially by the free use of grease, oily enemata, and medicines. Fæcal accumulation.

The fact that fæcal accumulation may give rise to the worst symptoms of mechanical obstruction, and even to death, should always be before the Surgeon, and induce him to examine the rectum with care in all cases of obstruction.

Obstruction due to tumour.

Obstructions due to the presence of some abdominal tumour, hydatid, cancerous, ovarian, or otherwise, are to be diagnosed and dealt with on their own merits, although when it is the lower part of the bowel that is obstructed, right or left lumbar colotomy should not be neglected when other means of relief are not available. I have performed this operation on most occasions for such a cause with gratifying success.

Diagnosis between stricture and contractions.

We come now to the two larger divisions of cases, viz. those of *stricture* and of *contractions*, and a very little consideration will show that these cases have as distinct a clinical history as they have a pathology, and that they, moreover, require a distinct line of treatment.

With respect to their pathology, it may at once be stated that "contraction" is the cause of chronic obstruction of the small intestines, and "stricture" of obstruction of the large bowel.

That the cases of "contraction" are due to the matting together of the intestinal coils from more or less diffused inflammatory or cancerous peritoneal disease, while cases of stricture are due to a local narrowing of the bowel from disease of its coats.

In the cases of "contraction" the action of the intestines (small or large) is interfered with from adhesions, or from a bending or doubling of the bowel upon itself, and consequently there is an interference with the peristaltic movements. In those of "stricture" the action of the bowels is prevented from the direct mechanical obstruction occasioned by the stricture.

The clinical history and symptoms of these two classes of cases consequently differ.

In the case of "contraction" the symptoms are clearly referable to a difficulty in the passage downwards of the intestinal contents; in that of "stricture" to a difficulty in defæcation.

Symptoms of contraction.

In the *former* case the symptoms are attacks of griping, colicky abdominal pain, irregular and incomplete intestinal evacuations, and the painless discharge of healthy motions. In the *latter* there is

Of stricture.

mostly an absence of abdominal pain beyond that due to distension, more or less complete constipation, alternating with looseness of bowels, the occasional or frequent mixture of mucus or blood with the motions and painful defæcation.

In "contraction," when sickness exists, it will be passing and lasting only during the attack of colicky pain. In "stricture" it will occur towards the close of the disease when the obstruction is more complete.

In "contractions" the abdomen probably will not be much distended, and if it be so, only during the attack; the distension, moreover, will be central and hypogastric. "The intestines will then," writes Fagge, "be seen writhing and coiling, and a gurgling of fluid is heard; there will also be visible distinct peristaltic movements of the intestines." In "stricture" the abdomen will, to a certainty, be distended, and the distension will be lumbar and epigastric; large coils of distended bowel will also be visible with peristaltic movements, the visible peristalsis in both cases being due to the chronicity of the affection, and consequently to the hypertrophy of the bowel from overwork.

Such, then, are the broad points of distinction between the two large

classes of cases of chronic intestinal obstruction, and they are enough to guide the Surgeon in his practice. At times, however, the distinctions fail. Indeed, when the history of a case of either contraction or stricture is deficient, the diagnosis is most difficult, and if seen when the symptoms are at their height, one or other may be mistaken for a case of acute obstruction: the chronic symptoms of which nothing can be known, having lighted up into the visibly acute, in the same way as a case of incarcerated or obstructed hernia may suddenly develop into one of acute strangulation.

Having, then, thus mapped out the chief points of distinction between the two classes of cases of chronic intestinal obstruction, and bearing in mind that in the "contractions" the small intestines are the parts that are involved and in the "strictures" the large, it remains for the Surgeon in the latter class of cases to determine the seat of the disease, for a correct knowledge upon this point is clearly requisite before any precise operative treatment can be entertained. On reference to the table, this point comes out very strongly—for out of 104 cases which have been tabulated, in 78 the disease was in the sigmoid flexure or rectum; in 19 it was in the colon or one of its flexures; and in 7 it was about the cæcum. In three fourths of the cases the disease was consequently below that part of the bowel that would be opened by left lumbar colotomy, and in about four fifths below the seat of right lumbar colotomy; in but a very insignificant number was it higher up.

Seat of stricture in large intestine.

With these hard facts before us, the conclusion seems tolerably clear, that in all cases of obstinate constipation due to mechanical obstruction in the large intestine, when medicinal treatment has failed, and the removal of the disease by operative measures is out of the question, instead of wasting valuable time by the persistent administration of aperients which must do harm, of enemata which can do no good, of opium and allied remedies which only mask symptoms and mislead the practitioner, colotomy should be performed. The operation should be in the *left* loin, when the diagnosis has been made of disease of the rectum or sigmoid flexure, and in the *right* when the exact position of the stricture cannot be determined; for from our table it would appear that in not one case in fifteen is it likely to be above this point; right lumbar colotomy also so far as the relief it gives is as satisfactory an operation as left. It must be stated, moreover, that this relief should not be postponed too long, because from the facts alleged the operation will be of little avail when from the mechanical effects of the fæcal distension a peritoneal inflammation has set in, or changes have taken place in the cæcum or large intestine of an ulcerative or inflammatory character.

Colotomy in stricture.

With respect to the treatment of "contractions," much may be done by judicious medical measures, more particularly by helping the passage onwards of the contents of the intestinal canal, by means of laxatives, those of an oily kind being the best, such as the oily mixture of the Guy's Pharmacopœia.

Treatment of contractions.

Enterotomy.

A time will, however, come when these means will fail and others must be looked for, unless the patient be left to his fate; and of these "enterotomy" is most applicable. The operation consists in opening the small intestine in the right or left iliac fossa, and so establishing an artificial anus.

The operation will be considered further on.

Intussusceptions,

Intussusception.

or the invagination of some portion of the bowel into a lower segment (Fig. 257), may occur at any period, though more common in infancy and child life. They may take place also in any part of the intestine—my table recording that out of the 15 cases tabulated, 2 were rectal, 7 ileo-cæcal, and 6 small intestine. These statistics are supported by Gay's analysis of 74 cases, in which 8 involved the large intestine alone and were colic, 33 ileo-cæcal, and 33 small intestine. The rectal variety is, however, more frequently found in the adult, the iliac in young adults, and the ileo-cæcal in infancy and childhood. When the invaginated portion of intestine becomes *strangulated*, the symptoms are acute; when simply *incarcerated*, they may be chronic. Sudden invasion of symptoms, however, is the rule in both forms, with tenesmus and muco-sanguineous discharges, more particularly when the ileum is involved; discharge of blood per rectum occurs in the acutest cases.

Strangulated or incarcerated.

Symptoms.

The symptoms may be very acute and destroy life in three days, or so mild as to be only those of intestinal irritation. The development of symptoms as well pointed out by Mr. Howard Marsh ('St. Barth. Rep.,' vol. xii, 1876, p. 98) depend upon the occurrence of constriction—an intussusception in this respect being like an hernia, which may be "down" without being strangulated or even obstructed—the various symptoms in each case depending, not on the mere displacement of the intestine but on the constriction produced by the displacement.

FIG. 257.



Intussusception, with diagram showing the entering, returning, and receiving layers of ileum into colon.

Diagnosis between band and intussusception.

When *acute*, a case of intussusception at its onset may be mistaken for one of strangulation by a "band," and yet marked points of difference exist between the two. In both, the attack is sudden, and followed by collapse, but in the case of a *band*, pain is localised from the first, is paroxysmal, and remains severe to the last, and is also unassociated with tenesmus. In the *intussusception*, pain varies much both in seat and intensity, is often relieved by pressure, and towards the last ceases. The pain is likewise commonly associated with tenesmus. In strangulation by a "band" vomiting soon becomes fæcal and is constant; in "intussusception" it may also be the same, but it as often ceases. In "band," constipation is the rule, with inability to pass flatus; in "intussusception" diarrhœa, tenesmus and bloody mucoid stools are characteristic;

constipation is, however, at times present in chronic cases. In "band," central and hypogastric abdominal distension is an early symptom, in "intussusception," it may never exist. In "band," the most that may be felt is a single coil of distended bowel; in "intussusception" a distinct tumour may be felt.

Dr. Leichtenstein, of Tübingen, in a valuable analysis of 593 cases of this affection ('Prager Vierteljahrschrift,' Bd. 119, 121, 1874), informs us that when a tumour is recognised in the epigastric region, the ileum is probably the part invaginated; when in the right iliac fossa the ileum into the cæcum; and when it can be felt in the rectum it is probably ileum. Mr. Morris ('Path. Trans.,' p. 133, 1877), has, however, pointed out the possibility of mistaking blood clot in the rectum for the lower end of intussuscepted bowel, so that the use of the speculum should be brought to the aid of the finger in any case of doubt. Leichtenstein says also that when the intussuscepted portion of bowel sloughs off it occurs between the eleventh and twenty-first day from the beginning of the disease, and that it is generally part of the ileum. This result, however, is very rarely met with in infancy.

Treatment.

In the treatment of intussusception, operative interference is not to be undertaken in a hurry, as it is not to be questioned that cases of this affection constantly occur which right themselves either by or even without the aid of medical or surgical treatment, the bowel either freeing itself by an unexplained process, or, in some acute cases sloughing away, and a so-called cure resulting. Fagge, however, well observes upon this point that "when this cure by expulsion occurs it frequently only postpones the fatal termination instead of entirely preventing it. The patient dies some months afterwards from contraction of the cicatrix which had formed at the seat of the disease, this fact affording a weighty additional argument in favour of an attempt to explore and pull out an ileo-cæcal intussusception when the case is correctly diagnosed at an early stage. Mr. Morris says "it would appear that when small intestine is intussuscepted into *small* intestine the *invaginating* portion, owing to its small relative size, is too much damaged by compression from within to allow of recovery by expulsion of the reflected and entering portions."

No operation should, however, be thought of in intussusception until well-considered minor measures have been employed and failed, care being taken that too much time is not expended upon them. In *acute* intussusception, however, where the bowel is clearly strangulated, but a few hours should be given, because unless relief is speedily found, death ensues, and the younger the patient the more rapid the result.

Of acute.

In *chronic* intussusception where the bowel is probably only incarcerated, the Surgeon should not withhold his hand for more than a week; because if relief is to be obtained by treatment, it should be obtained within the seven days it is justifiable to expend in the attempt, and if failure follows, the operation of laparotomy should be undertaken. In acute strangulation if relief is not speedily found, sloughing of the invaginated bowel may take place, and in the chronic, adhesion of the invaginated bowel; under either circumstance operative interference must fail.

Of chronic.

Operative interference in intussusception, however, has not hitherto been very successful, and its failure, I believe, is owing to its having always been postponed to too late a period. Yet recent experience has been more encouraging, even under not very favorable circumstances,

Operative interference.

for Hutchinson has recorded a case ('Med.-Chir. Trans.,' vol. lvii, 1874) in which he opened the abdomen of a child æt. two, on the thirtieth day of the symptoms, and drew out the invaginated bowel with a successful issue. Mr. Howard Marsh had a second case, in which a like good result was obtained in a male infant seven months old after symptoms of fourteen days' duration; while my colleague, Mr. Howse, had a third, in a woman æt. 23, a patient of Dr. Fagge's (ibid., vol. lix, 1876) in which recovery took place. I have likewise performed the same operation in a dog, pulling out on the fifteenth day six feet of invaginated bowel with a good result.

Inflation. Dr. H. B. Sands, of New York, has also published another successful case in a child 6 months old ('New York Med. Journ.,' June, 1877)—the operation having been performed eighteen hours after the appearance of the symptoms. In intussusception, however, some success has followed, at times, the practice of inflation, a plan of treatment that was originally recommended by Gorham years ago. When inflation cannot be used injections may be substituted. This operation has, however, its dangers, as bowels have been ruptured by its use. I cannot therefore recommend it.

Inversion. *Inversion* of the body has likewise been advised, with the chance that the weight of the contents of the bowel above the involuted or obstructed segment may suffice to disengage it. Mechanical kneading of the abdomen, and the administration of an anæsthetic have also been employed with a similar object.

Opium. Opium should always be given in all cases of mechanical obstruction, the drug not only relieving pain, but checking the peristaltic action of the bowel which is so injurious.

These remedies, however, are doubtful at the best; they should, however, be tried in early cases, as well as when the diagnosis is uncertain; they must not be used when the diagnosis is certain or more active treatment is called for, unless such treatment is absolutely rejected.

Laparotomy,

Laparotomy "an operation of search." from λαπαρα, the soft parts of the body below the ribs, and τεμνω, I cut, is a name which has been given by Dr. John Ashhurst, jun. ('American Journ. of Med. Science,' 1874), to an exploratory operation upon the abdomen for the relief of an internal strangulation or intussusception, and is so good that I adopt it. The term "gastrotomy" is applied to operations upon the stomach for the removal of foreign bodies, "gastrostomy" to an operation upon the stomach with a view of establishing a permanent fistula, "colotomy" to those upon the large intestine, and "enterotomy" to those upon the small.

In laparotomy the abdomen should be opened in the median line below the umbilicus, though if an old hernia exists, the sac should be explored, and the abdominal incision made upwards from its neck. The abdomen should at first be explored by the finger, and more particularly towards the umbilicus, since it seems that bands are more often found opposite the promontory of the sacrum than anywhere else. The finger should then be passed towards the right iliac fossa to examine the cæcum and to feel for the contracted empty small intestine, which so frequently dips into the pelvis at this spot, and if found forms the best guide to and proof of intestinal obstruction. If the finger fail to find out the seat of obstruction, the opening must be enlarged and the

parts inspected. When the operation is performed for intussusception, and the bowel is exposed, difficulty has been experienced in freeing the involved bowel, and, under such circumstances, the expedient used by Mr. Hutchinson should be employed and the invaginated portion pushed out backward from its sheath. After the operation, the peritoneal cavity should be well cleansed with antiseptic sponges, and the wound carefully adjusted by stitches. The patient should be kept under the influence of opium or morphia—the morphia suppository every five hours being the best form to use. Milk diet should be given in small quantities, and, if recovery is to follow, it will probably be speedy; as repair takes place rapidly in all abdominal sections when a case goes on well, and death ensues early when the reverse occurs. Ashhurst has collected 123 cases of laparotomy of which 37 recovered and 86 died.

Enterotomy,

Enterotomy.

or the opening of some portion of the small bowel generally in the right groin, is an operation of great value, and it is to be regretted that it has not received sufficient notice. It was first performed by Nélaton, at least twenty-five years ago, upon a patient of Trousseau's, for chronic intestinal obstruction, and is applicable to cases of abdominal obstruction in which the clinical evidence points to the conclusion that the obstruction is high up in the large intestine or low down in the small; to cases in which "laparotomy" is inapplicable and "lumbar colotomy" is out of court—to cases of obstruction in which relief is required, and a more exact method of giving it is not clear, either from some difficulty in diagnosis or other cause. It is described by Trousseau as follows ('Clin. Med.,' lecture 77):—"I begin the

When applicable.

The operation.

Fig. 258.

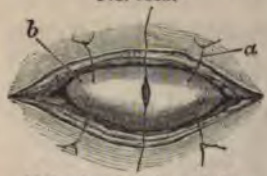


Inguinal wound made in Nélaton's 'Operation of Enterotomy.'

operation, as Nélaton advises, by making in the right side an incision an inch in length, a little above the crest of the ilium parallel with Poupart's ligament (Fig. 258); the length of this incision is subsequently increased to three or four inches. In dividing, layer by layer, the skin, the cellular tissue, the muscles, and aponeuroses, tying as may be required the large vessels involved in the incision, we at last come to

the most deeply-seated aponeurosis. Proceeding always very slowly, and being very particular in sponging the wound carefully, this deep aponeurosis is cut through, when forthwith the peritoneum is reached. It is taken hold of by a small forceps and incised; afterwards using the greatest possible precautions, a silver thread, by means of a curved needle is carried, first through the intestine and then through the abdominal walls; four sutures are then made, two on each side of the incision; two others are made, one at the superior and the other at the inferior angle of the wound; but this time the abdominal parietes are first perforated, then the intestine, and afterwards the abdominal parietes on the opposite side of the wound (*vide* Fig. 258A). In this way the intestine is fixed everywhere, laterally and from above downwards to the walls of the abdomen; by this proceeding no exudation can take place into the peritoneum. *It is then only necessary to make an exceedingly small incision in the intestine* by means of a sharp-pointed bistoury. The opening which Nélaton makes is less than a third of an inch."

FIG. 258A.



Mode of securing bowel before opening it.

If the case is not so urgent as to demand immediate relief, it would be well to postpone opening the small intestine for one or two days, in order to give time for firm adhesion to take place between the bowel and the abdominal parietes. Indeed, it may be a question whether it is necessary to fix the intestine to the abdominal parietes by sutures, and whether it will not adhere to the part as a result of its simple exposure in the wound.

This operation is very warmly advocated by Trousseau in all cases of intestinal occlusion, from whatever cause, "when the symptoms of occlusion have existed for six or eight days, when there is great tympanitis, when the matters vomited are of a stercoraceous character, and, finally, when the persistence and severity of the symptoms presage imminent death." He had recommended its adoption in five cases, and in two with complete success, the patients recovering, who, without it, would have been hopelessly lost.

In recent times this operation has been successfully performed by Mr. McCarthy on the suggestion of Mr. Maunder in 1872 ('Med.-Chir. Trans.,' vol. lv), by Mr. Wagstaffe ('St. Thomas's Hosp. Rep.,' 1873), by Mr. Maunder himself in November, 1875 ('Trans. Clin. Soc.,' vol. ix, 1876), and by others.

Cases.

I have performed it three times, once in 1876 on an infant twelve days old, who was born with an imperforate rectum, and survived the operation eight days, having been greatly relieved by it, but operation had been postponed until too late. The second was in May, 1877, on a man, æt. 57, who had been a patient of Dr. Wilks, for chronic obstruction of small intestine of many months' standing, the chronic condition being aggravated every week or ten days by symptoms of a severe character, which threatened life. The seat of the obstruction was too uncertain to allow of the operation of colotomy being performed; indeed the symptoms pointed to the small bowel as being the seat of the disease, and on that account enterotomy was

undertaken. The operation gave rapid and permanent relief, and the man was convalescent in a month. His temperature, as shown by the chart, was never higher than 100°. He is alive and well at the present day; but the inconvenience connected with the artificial anus is so troublesome as to neutralise greatly the advantages of the operation. The third was on the person of a man, æt. 50, whom I saw in consultation with Dr. Cortis, of Kennington, in July, 1877, for complete intestinal obstruc-

FIG. 259.



Thermograph of case of enterotomy, in a man, æt. 57, for chronic obstruction. Temperature never reached 100°, and patient was convalescent in a month. Fluctuation of temperature very slight.

tion. He had been ill two months with abdominal pain and constipation, but sought advice only when the pain had become very severe and vomiting appeared. When I saw him the constipation was insuperable, vomiting incessant, and the abdomen much distended. No obstruction could be felt in the rectum; both loins were very resonant, and it was believed that the obstruction was about the cæcum. I consequently performed Nélaton's operation of enterotomy as described, on July 7th. The operation gave immediate relief, and everything went on well subsequently, the temperature never rising beyond 99°. He left the hospital six weeks afterwards, the whole of his motions passing through the artificial anus, and not a trace of wind or motion passing per anum.

On his return home, for want of good nursing, a bed sore appeared, and he died in November, 1877. After death it was found that the lower part of the ileum had been opened three inches from the cæcum, and that the seat of stricture was in the ascending colon just above the cæcum. It was cicatricial, and evidently due to the contraction of some old ulcer; the viscera were healthy. I subsequently learnt from Dr. Cortis that this patient had hurt himself in the right side of his abdomen three years before his illness in a fall over a case of goods, that the accident was followed by sickness and pain, with nausea and occasional vomiting. It is quite possible that the stricture was the result of this injury.

This patient, as well as the other, complained sadly of the annoyance caused by the constant flow of fæces from the inguinal anus, no mechanical appliance having the power of controlling it.

Colectomy.

This term is applicable to cases in which a portion of the colon has been removed, either by abdominal section or through a lumbar wound. Under the former circumstances the operation might be called "abdominal," and under the latter "lumbar colectomy."

I was the first to suggest and to perform the latter operation in country, and I did so, on September 10th, 1881, for a lady æt. 50, had suffered from eight weeks' obstruction, with such success that lived between thirteen and fourteen months, and died October 1 1882, of cancer of her liver and spleen (*vide* 'Med.-Chir. Tr vol. lxv, 1882).

Operation. I commenced the operation with my usual oblique lumbar inci as for "Colotomy," and having reached the bowel, and found tha strictured portion could be drawn out of the wound, I determin excise it. This I did by first stretching the presenting wall of th testine above the strictured portion to the margins of the wo evacuating the contents of the bowel through a limited orifice, and sequently securing the under lip of the upper portion of bowel t lower margin of the wound; having with scissors carefully deta the strictured segment of the colon from its upper attachments, stretched the bowel to the orifice of the wound step by step.

The strictured segment of gut was then separated from its att ments below, and the upper orifice of the lower portion of the b carefully secured to the wound in close contact with the upper por Great care was observed all this time to keep the parts clean, and vent anything gravitating into the abdominal cavity.

The operation was not a difficult one.

The idea of removing an organic structure of the large b through the wound made for a left lumbar colotomy, suggested i to me several years ago, after having seen, both in operations of tomy as well as in the post-mortem room, many examples of annul localised structure of the bowel, which were freely moveable in the toneal cavity, free from all attachments, and within easy reach of Surgeon's fingers, through the lumbar wound. For it is in these c and in these alone, that the operation is possible.

The thought was likewise encouraged by the analyses of cases t lated in page 708, from which it was shown that in three out of cases of chronic intestinal obstruction the stricture is located i descending colon, and that in about one-third of these cases the di is of an annular or local character, such strictures being the malignant of epithelial growths.

Should this operation meet with the support it deserves, some ch in practice may be required, for it would be wise to entertain the ration of colectomy at an earlier period of the stricture's progress it has hitherto been the custom for Physicians or the majorit Surgeons to entertain that of colotomy, since the operation of c tomy would be more readily performed when the bowel above stricture is undistended and comparatively healthy, than when it is of retained fæces, and probably ulcerated from over-distension. operation, moreover, when performed under those more favorable cumstances, would be safer, since, in the healthy bowel above and b the strictured segment, the Surgeon may with more confidence d the inward portion upwards from the pelvis, or downwards and b wards from the splenic region, and consequently remove it with gre safety and facility.

The consideration of colectomy in any given case will consequ give a help to colotomy where it is most needed, for it will encou medical men to entertain the question of operative relief for obst

tion as soon as the diagnosis of organic stricture has been made, and not to postpone it, till, as I have heard it advised, obstruction has existed for six weeks, when the chances of success by any operation are, indeed, small.

I believe the operation of colectomy for the treatment of localised strictures of the sigmoid flexure will be found to be a valuable additional means of giving relief, and possibly of curing a certain proportion of cases. It should be considered in all cases of stricture of the descending bowel, not rectal, and entertained as soon as the diagnosis of the case has been made, and before symptoms of obstruction are a source of anxiety, or of a threatening character.

I have seen two cases since the one recorded in which the operation seemed desirable. In one the advice was rejected—in the other it was acted upon—and the Surgeon who performed it found the diagnosis correct, and removed the stricture, but without success. My friend, Mr. John Marshall, has recorded a later case in the 'Lancet' for May 6th, 1882, and has given an interesting lecture upon the subject, which may be read with benefit.

Colotomy.

On the operation of colotomy.

For irremediable stricture or mechanical obstruction of the rectum from any cause, when colectomy is inapplicable, *Callisen's* operation of opening the colon in the *left* loin should be followed; but when the seat of obstruction is higher than the rectum, and if there be a doubt whether it is in the sigmoid flexure or transverse colon *Amussat's* operation in the right loin should be performed. Callisen first suggested colotomy in 1796, and applied it to the descending colon, but Amussat revived the operation, and extended it to the ascending colon in 1839.

The colon in this position lies behind the peritoneum, immediately beneath the transversalis fascia. The kidney is in close contact with it above, and in one case on which I operated the organ was placed so low down as to fill in the space between the rib and pelvis, and had to be pushed upwards to allow the colon to be seen and opened. The operation on the left loin can be performed as follows:

Mode of performance.

The patient is to be placed on his right side, with a pillow beneath the loin, in order to arch somewhat the left flank, and he should be turned two thirds over on his face; the outer border of the erector spinæ and of the quadratus lumborum muscle can then be made out; this latter muscle which is on a deeper plane being the Surgeon's main guide. Its outer border with the descending colon is to be found half an inch to an inch posterior to the centre of the crest of the ilium; the centre being the point midway between the anterior and posterior superior spinous processes. Allingham says that in more than fifty dissections he has always found the descending colon to be situated at the former point. When difficulties are felt in the operation he believes they arise from the colon being looked for too far from the spine ('St. Thomas's Hospital Reports,' 1870), and in that opinion I cordially agree. An incision is then to be made four or five inches long, beginning an inch and a half to the left of the spine below the last rib, and passing downwards and forwards parallel with the crest of the ilium; the line of the incision should pass obliquely across the external border of the quadratus lumborum muscle about its centre, so as to take the same

direction as the nerves which traverse this part. By this incision the integuments and muscles and fascia are divided, and the outer border of the quadratus muscle exposed. The abdominal muscles can be divided to give room. All vessels are now to be secured. The transversalis fascia will next come into view, and beneath this will be the colon, a layer of fat intervening. The fascia is to be opened with caution, for in the loose fat and cellular tissue the colon is to be found; when distended, the bowel, on dividing the fascia, comes at once under the eye, but when empty some little trouble may be experienced in hooking it up with the finger. The inflation of the colon with air by means of an enema syringe or Lund's apparatus is at this stage of the operation often of great assistance, the inflated bowel rolling up into the wound in a very satisfactory manner. The bowel can always be found in front of the lower border of the kidney. This organ should consequently be sought, as it is the only certain guide to the bowel. I have found, however, on several occasions at this stage of the proceeding, great help by rolling the patient over on his back, the bowel falling by this manœuvre on the finger, and being then readily caught.

When colon is empty.

Care in not wounding the peritoneum.

When the bowel has been caught it should be partially rolled forward, in order to expose its posterior surface, for if this be not done there is a risk of the Surgeon wounding the peritoneum where it is reflected from its anterior surface on to the abdominal wall. The bowel having been drawn up to the wound is then to be secured to the integument, and not to the muscles, by the passage of a ligature introduced through one margin of the wound, then through the bowel, and lastly through the other margin. The bowel can then be opened by an incision about half an inch long between the ligatures that have traversed its canal; the centres of the ligatures are then to be drawn out through the wound and divided, the two halves of the ligatures fixing the two sides of the divided intestine firmly to the margins of the wound; two or more stitches may then be introduced to make the artificial anus secure. When the necessity of giving relief to obstruction is not great the bowel may be carefully stitched to the margins of the wound and opened, as in enterotomy and gastrostomy, on the third or fourth day, the risks of peritonitis being diminished by this means. The Surgeon may, however, do what my colleague Mr. Howse has done, simply draw the bowel out of the wound, and hold it out for two or three days by means of forceps, when the protruded bowel will have become firmly united to the margins of the wound, and may be opened with safety, or removed as in a colectomy. The margins of the wound may be oiled to guard against the irritation of fæces, and the patient placed in bed. At times the fæces escape in large quantities directly the bowel is opened; at others some slight fæculent discharge will take place at the time, the larger flow taking place later. This is not, however, a matter of any importance, and the Surgeon should take no measures to cause the bowels to act; indeed, it is better, as far as the operation is concerned, that the flow be postponed, for within an hour or so the parts about the wound become sealed with lymph, and thus the risks of extravasation are diminished.

Passage of ligatures.

Opening of gut.

Mode of fixing gut.

Variations in the operation.

Callisen originally suggested the *vertical* incision in the left loin, and Amussat the *transverse* in the right, the latter crossing at right angles the outer border of the quadratus lumborum muscle, the former running parallel with it. The oblique appears to me to be preferable to

either, as it gives more room for manipulation when the colon is empty, it takes the line of the nerves and vessels that traverse this part, and lessens the risk of their division; it follows the ordinary integumental fold of a patient when assuming the recumbent posture, and thus favours repair, and seems to tend much towards the prevention of the prolapse of the bowel that is always liable to follow such an operation. Fig. 260 illustrates the line of incision and the appearance of the artificial anus. It was taken from a patient, æt. 64, that I operated upon in 1869 for vesico-intestinal fistula, and who died five and a half years subsequently (1875) from a ruptured heart. The gentleman followed his avocation without any discomfort.

After treatment.

After the operation a sedative should be given, such as opium, morphia, or chloral, and the recumbent position maintained, a piece of oiled lint covered with oakum, and kept in place with a soft towel, being the best application.

Sutures removed on fourth day.

The sutures may be removed on the fourth or fifth day, according to circumstances, while perfect cleanliness must be observed.

Nutritive food and stimulants may be given within a day or so of the operation, repair, as a rule, going on favorably.

Fig. 260.



Artificial anus after colotomy with the oblique incision.

Appliances after cicatrization.

When the wound has cicatrized, the patient may get up, and a pad applied, covered by a folded napkin and fastened on with a lumbar binder or a pure rubber plug and shield as made for me by Messrs. Krohne, of 8, Duke Street, Manchester Square.

Value of the oblique incision.

With the oblique incision the prolapse of the bowel does not appear to be the cause of much annoyance, since it seems to take place to a very slight extent.

When contraction of the orifice takes place to too great an extent, a sponge tent or short bougie may daily be introduced. I have, however, met with but one case requiring this treatment.

Cleansing of the lower bowel.

After convalescence, it is well to wash out occasionally the lower portion of the bowel with warm water, as some fæces are apt to pass the artificial opening and rest in the rectum, causing irritation. When

the anal end is open, it is best to do this through the natural opening, and when closed through the artificial.

Prognosis.

I have now performed this operation about eighty times; and in no single case have I ever regretted doing so, although in a large number I have wished earnestly that I had had an opportunity of performing it earlier, since in no instance did it fail to give relief. One of the cases of vesico-intestinal fistula lived nearly six years after the operation, and died, æt. 70, from rupture of the heart. Another is now alive, thirteen years after the operation, and enjoying life, suffering indeed very little inconvenience from the artificial anus. ('Clin. Soc.,' 1872.) The patient with fibrous growths in the rectum was operated upon Nov. 14th, 1877, and is now living in comfort.

Statistics of the operation.

Of the patients with stricture, cancerous and otherwise, one lived five years, two four, three lived three years after the operation, and several two, and very many one. Many were alive when last heard of, two having been operated upon three years previously, two two years, and two within the year. In every case marked relief was afforded to symptoms, and in many, the patients' expressions of gratitude for such were very strong, several having deeply regretted that the operation had not been performed at an earlier period. In many of these cases the operation was undertaken as a last resource.

In one of the patients colotomized for vesico-intestinal fistula, who is now alive, thirteen years after the operation, urine finds its way, when he is recumbent, out of the lumbar artificial anus, and in another that survived the operation nearly six years, the same complication presented itself. In neither instance, however, was the flow a source of trouble. This flow, however, might have been enough to keep patent that portion of the intestine that existed between the artificial anus and the bladder, and to preserve it from atrophy; such a result of colotomy being clearly possible. The late Dr. Michael Harris, of Liverpool, recorded in the 'Liverpool Hospital Reports' for 1874 the particulars of a post-mortem examination where Mr. Hakes had performed colotomy five years previously for vesico-intestinal fistula, in which the descending colon from the artificial anus, together with the sigmoid flexure and rectum as far as the bladder, had become *completely obliterated* and was found to be replaced by a cylindrical mass of fat. The length of this fatty column was about six or seven inches, and in the centre of it was found a fibrous cord of about a line in thickness, but no trace of a canal of any kind could be therein detected.

Operation when advisable.

The operation of colotomy is beneficial in all cases of vesico-intestinal fistula when solid fæces flow with the urine; in all cases of stricture of the rectum that cannot be removed by colectomy so soon as the obstruction becomes serious and local distress great; in all other cases of mechanical obstruction to the rectum from pelvic causes, when no less severe measures for relief can be suggested; and, last, but not least, in extensive ulceration of the rectum, cancerous, syphilitic, or simple, when local treatment fails to give relief, and local distress is great—when the general powers are evidently giving way from the local disease, quite irrespective of mechanical obstruction.

In no case, however, should the operation be postponed till the patient's powers are failing, when the prospects of recovery would be greatly lessened, and convalescence is often rendered improbable.

REMARKS.

SINCE this Chapter was written I have been induced to tabulate and analyse my own cases of lumbar colotomy, and to embody the results of the analysis in a paper which I read at the Copenhagen Medical Congress, 1884 (*vide* 'Transactions').

The Tables, and the conclusions drawn from the analysis and consideration of them, tell much in favour of lumbar colotomy; and on that account I have deemed it expedient to introduce them in this volume.

The conclusions to which I was led in my paper were embodied in the following propositions, which I believe my material proved.

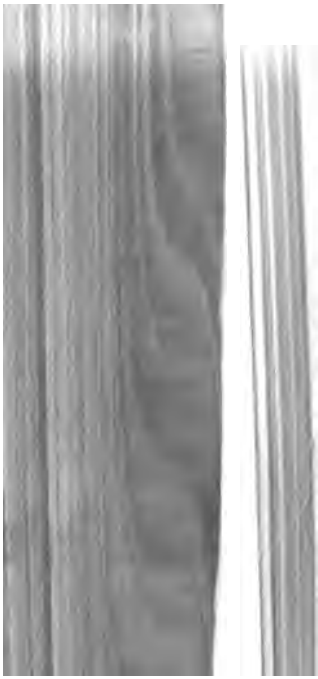
PROPOSITIONS.

1.—That in all cases of cancerous stricture of the rectum or colon, including the annular,—which are not amenable to lumbar *colectomy* or anal excision—right or left lumbar colotomy is strongly to be advocated with the well-grounded hope of relieving suffering, retarding the progress of the disease, and of prolonging life even for five or six years.

2.—That lumbar colotomy is valuable as a *curative* operation in syphilitic and simple ulcerations of the bowel which resist other treatment, including cases of recto-vesical fistula; and that it is remedial in examples of volvulus of the sigmoid flexure, as well as of obstructions caused by tumours.

3.—That to secure these advantages, it is necessary for the operation to be performed before the pernicious effects of obstruction occur.

I trust this material will help to place the operation of lumbar colotomy in the position to which it is entitled.



4	Hospital
5	Hospital
6	Hospital
7	*Private*
8	Hospital
9	Hospital
10	*Private*— Mr. R.
11	*Private*— Dr. Bab
12	*Private*
13	Hospital
14	*Private*— Drs. Hu Habe
15	*Private*— Dr. Ow
16	Hospital
17	Hospital
18	Hospital
19	*Private*- Dr. Go
20	Hospital
21	*Private*- Dr. De
22	*Private*- Mr. E.
23	*Private*-

thin the Month. "Too Late Cases."

h Operation was Performed.	*Result.*	*No.*
re of rectum. Obstruction weeks	Sank. Died on 12*th day*, greatly relieved.	1
ure of rectum. Symptoms	Sank on 2*nd day*.	2
anus and rectum of 6	Died on 24*th day*. Sank, operation wound healed. P. M.—Cancer of viscera.	3
ure of rectum. Symptoms	Sank on 3*rd day*. P. M.—Large cancerous mass in pelvis.	4
ture of rectum. Severe nonths	Sank on 6*th day*. P. M.—Disease quite local.	5
ure of rectum. Symptoms for months	Sank on 3*rd day*. Peritonitis: bowel had ruptured above the stricture.	6
ure of rectum. Obstruction reeks	Sank on 20*th day*.	7
ruction for 6 years. Recto- for months	Sank on 10*th day*. Cancerous ulcer into bladder, with secondary growths.	8
ture, with symptoms for 5 action for 5 months.	Sank on 3*rd day*. Peritonitis; cancerous ulcer between the rectum and jejunum.	9
ture of rectum of many ing	Sank on 4*th day*.	10
ion complete	Sank on 7*th day*.	11
ure of rectum	Sank on 3*rd day*.	12
se of rectum, with fæcal is	Sank on 3*rd day*. Peritonitis. P. M.—Bowel above stricture ruptured.	13
e of transverse colon. Sym- obstruction 4 weeks	Sank on 10*th day*. P. M.—Confirmed diagnosis.	14
ure of rectum of slow con-	Sank on 5*th day*.	15
ure of rectum. Symptoms Blood	Sank on 3*rd day*. P. M.—Cancer in viscera and peritoneum.	16
ure of rectum. Pain, blood ith fæces, for 8 years	Died on 18*th day* suddenly, from sudden pain, collapse, and ruptured spleen. No peritonitis.	17
cture of rectum. Nine	Sank on 23*rd day*. P. M.—Peritoneal cancer and volvulus of sigmoid flexure.	18
are of rectum many months. weeks	Sank on 3*rd day*.	19
ure of rectum. Bleeding	Sank on 4*th day*. P. M.—Peritonitis, and much cancer.	20
ure of rectum.	Sank on 5*th day*.	21
ure of rectum	Sank on 5*th day*.	22
are of rectum	Sank on 5*th day*.	23
are of rectum	Sank on 5*th day*.	24
ure of rectum and vagina	Sank on 27*th day*.	25
um	Sank on 4*th day*.	26

ide. Eighteen died in the first week, 3 in the second week, 2 in the 3 in the fourth week.

TABLE II.—Cases of

No.	Hospital or Private Patient.	Name of Patient.	Age.	Dat Opera
1	Hospital	James W—	39	July 31s
2	Hospital	*Martha* P—	57	May 31s
3	*Private*	*Miss* B—	18	Sept. 6t
4	Hospital	*Eliza* B—	38	Oct. 10t
5	Hospital	Richard C—	46	Jan. 9t
6	*Private*	*Mrs.* B—	24	Feb. 10
7	Hospital	George S—	56	April 14
8	*Private*—Dr. Stilwell and Sir W. Gull	*Mrs.* B—	72	Dec. 6t
9	*Private*—Dr. Brown, Ealing	Mr. R—	64	June 2n
10	*Private*—Mr. T. Harries, Aberystwyth	Mr. T. D—	57	Feb. 12
11	*Private*—Drs. Chambers and Menzies	Mr. A—	57	Dec. 30
12	*Private*—Mr. Hodgson, Brighton	Mr. B—	54	April 1
13	*Private*—Dr. Drewry	*Mrs.* B—	56	May 4t
14	*Private*—Dr. Wallace	Mr. S—	42	June 13
15	Hospital	John B—	39	June 27
16	Hospital	George W—	51	Nov. 12
17	*Private*—Dr. Bowes, Herne Bay	Mr. S—	64	April 3
18	*Private*—Dr. Kiddle, Leamington	Mr. H—	66	Nov. 8t
19	Hospital	*Mary* T—	59	Dec. 9t
20	Hospital	*Alice* P—	25	Aug. 6t
21	Hospital	*Eliza* C—	29	Feb. 3r
22	*Private*—Dr. Andrews	Mr. W—	42	Nov. 15
23	Hospital	*Emma* R—	38	Nov. 16
24	*Private*—Mr. J. Burton and Dr. Higgens	*Mrs.* S—	42	April,
25	Hospital	Charles H—	64	June 18
26	Hospital	Samuel Robinson	15	Dec. 30
27	Hospital	John James	60	Feb. 13
28	Hospital	*Eliza* W—	46	Feb. 4th,
29	Hospital	*Sarah* A—	33	Nov. 2n
30	Hospital	Richard H—	62	Feb. 10t
31	Hospital	Daniel S—	39	May 12t
32	*Private*—Dr. Bailey	Mr. S—	35	July 28t
33	*Private*—Dr. Calthrop	Mr. T—	62	Mar. 16t
34	Hospital	John C—	52	April 8th,

Analysis of the Thirty-four Cases, or 56 per cent.—9 die
lived from 6 to 12 months, 9 lived from 1 to 5 years, 1 was alive

ecovered from the Operation.

peration was d.	Result.	Survived Operation.	No.
rectum. Sym-	Convalesced. Died of abdominal cancer	18 months.	1
rectum	Convalesced in 7 weeks	*Left hospital.*	2
ctum	Convalesced. Died of internal cancer	9 months.	3
tum. Symptoms d mucus	Convalesced	Alive 5 years subsequently	4
septum	Convalesced	*Left hospital.*	5
ion, supposed to e	Convalesced. Sank	33 months.	6
rectum and anus,	Convalesced. Sank. Much local cancer, no visceral	10 months.	7
m and sigmoid	Convalesced. Sank later from disease	21 months.	8
f rectum, with months	Convalesced. Sank	3½ months.	9
rectum. Sym- g 6 months	Convalesced. Sank	16 months.	10
rectum 2½ years. ears	Convalesced. Sank	4 months.	11
rectum 1 year	Convalesced. Sank	7 months.	12
f rectum, with year	Convalesced. Sank	12½ months.	13
f rectum, with nths	Convalesced. Sank	12 months.	14
rectum. Sym-	Convalesced. Died of stricture of urethra (?)	10 months.	15
rectum. Sym- obstruction	Convalesced. Sank	9½ months.	16
rectum. Sym-	Convalesced. Died of apoplexy	41 months.	17
rectum. Sym-	Convalesced. Sank. Internal cancer	26 months.	18
ectum 9 months	Convalesced	*Left hospital.*	19
n	Convalesced. D. from perforation of growth into peritoneal cavity	5 weeks.	20
ptoms 6 months	Convalesced in 5 weeks	*Left hospital.*	21
rectum. Sym- ruction 2 weeks	Convalesced. Sank	3 months.	22
nd anus 2 years	Convalesced. Sank	13½ months.	23
ectum. Obstruc- te 2 weeks	Convalesced. Sank. Visceral cancer	15 months.	24
rectum. Sym-	Convalesced	*Left hospital.*	25
rectum. Sym-	Convalesced. Sank	3½ months.	26
rectum. Sym- mucus, and in- efæcation	Convalesced	*Left hospital.*	27
rectum. Sym-	Convalesced. Died from extension of local disease	6 weeks.	28
ectum. Sym- and pain	Convalesced. Died suddenly. Much local disease	30 days.	29
ectum	Convalesced in 6 weeks	*Left hospital.*	30
rectum. Sym-	Convalesced. Sank	10½ months.	31
ectum	Convalesced. Sank	6 months.	32
ectum	Convalesced. Sank	6 months.	33
ectum	Convalesced in 1 month	*Left hospital.*	34

nt; 21 occurred in males, 13 in females; 31 were on the left, and erage age 44; *of men 46*, of women 41.

TABLE III.—Cases of Colotomy for

No.	Hospital or Private Patient.	Name of Patient.	Age.	Date of Operation.
1	Hospital	*Eliza* O—, married, 2 children, 4 stillborn, 1 miscarriage	29	Mar. 19th, 1873
2	Hospital	*Louisa* C—	33	Dec. 5th, 1867
3	Hospital	*Mary* S—, married, no children	46	Mar. 3rd, 1876
4	Hospital	Hans K—, been abroad, but not had dysentery	65	Dec. 30th, 1881
5	Hospital	*Eliza* B—, married, 1 child, 1 miscarriage	42	Feb. 6th, 1883
6	Hospital	*Harriet* K—	37	Nov. 28th, 1877
7	Hospital	James R—	49	Nov. 14th, 1882
		Cases of Lumbar Colotomy for Non		
8	Hospital	William D—	46	April 5th, 1867
9	*Private*—Dr. Habershon	Robert R—	46	July 5th, 1870
10	Hospital	*Mary* L—	38	Aug. 12th, 1873
11	Hospital	*Mary* P—, married, no children, no miscarriage	37	Nov. 9th, 1881
12	Hospital	William H— no syphilis	27	Nov 7th, 1881
13	Hospital	Phillip K—	35	Dec. 2nd, 1882
14	Hospital	*Caroline* H—, married, had miscars.	28	May 10th, 1878
15	Hospital	William B—, syphilis 3 years	25	July 12th, 1878
16	Hospital	*Susan* S—, marrd. had miscarriages	40	May 3rd, 1881
17	Hospital	*Louisa* P—, married, 1 child, 1 miscarriage, had syphilis	24	Sept. 2nd, 1874
18	*Private*—Sir W. Gull	Mr. T—	64	Mar. 16th, 1869
19	*Private*—Mr. R. Phillips	Mr. S—	46	Nov. 14th, 1877
20	Hospital	John S—	38	July 16th, 1880
21	Hospital	Fred. R—	18	Mar. 2nd, 1874
22	Private—Mr. R. Phillips	Mrs. M—	46	April 5th, 1870

Analysis of Twenty-two Cases not Cancerous.—19 for stricture of the rectum not cancerous, 1 for obstruction from volvulus of the 2 ditto from pelvic tumours; 10 of the 19 cases of stricture ca

Stricture of Rectum that Died within the Month.

hich Operation was Performed.	*Result.*	*Survived Operation.*	*No.*
icture of rectum. After last ears ago, had bowel trouble, ave rise to fæcal, vaginal, and ulæ	Sank. P. M.—Good repair in loin; rectum almost obliterated from cicatricial bands	On 13*th day.*	1
ation of rectum, with increas- ion for months	Sank. P. M.—Sigmoid flexure, rectum and uterus all matted together; bowel very narrow and thickened	On 4*th day.*	2
stricture from 1 inch above mucus, and pain for months, ing obstruction	Sank. P. M.—Extreme ulceration of rectum from 2 inches above anus, with sinus	On 3*rd day.*	3
recto-vesical fæcal fistula of 6 ing; 12 years before this pa- weeks passed wind with his which he had recovered	Sank. P. M.—Marked signs of old ulceration and contraction of rectum; sign of old cicatrix into bladder, with recent fistula	On 17*th day.*	4
icture, with ulceration of 5 ng, commencing ½ inch from	Sank. P. M.—Bowel very ulcerated and friable up to colon; it had been torn through at operation	On 4*th day.*	5
tricture and ulceration after 6 ptoms	Convalesced. Died of phthisis. Bowel repaired; one stricture 3 inches, and a second 6 inches, from anus	28 *days.*	6
ulceration. Much pain and onths	Sank. P. M.—Colon much ulcerated; bowel contracted	30 *days.*	7

r Disease that Convalesced after Operation.

fæcal fistula, with rectal ob- d ulceration	Convalesced. Died of kidney disease, Rectum repaired and contracted	5 *months.*	8
fæcal fistula, with obstruction	Convalesced	14 *years,* alive & well.	9
rectum after ulceration for 6 h bleeding	Convalesced. Died of kidney disease; rectum healed and contracted	34½ *months.*	10
ms for 15 years. Pain, blood, fæces. Admitted with narrow obably syphilitic	Convalesced. Sank from kidney disease and large spleen; lower 3 inches of rectum, lost its mucous membrane with cicatricial tissue outside	40 *days.*	11
d ulceration of rectum 17 ood and mucus with fæces	Sank	18 *weeks.*	12
ulceration of rectum. Sym- ears	Convalesced. Bowel healed and almost closed	18 *mons.*, well comfortable.	13
cture and ulceration 30 months. es passed for 6 months	Convalesced. Died from bronchitis	1 *year.*	14
stricture, 1½ inches above anus. or 2 years	Convalesced. Bowel had healed and almost closed 2 years later	2½ *years* later alive & well.	15
h narrow stricture and vaginal l fæcal fistula. No history of	Sank. P. M.—Rectum greatly indurated, contracted, and ulcerated; ulcers vertical	9 *weeks.*	16
th recto-vaginal fæcal fistula buttock. Operation performed	Died of hip disease. All the fistulæ had closed soon after operation. P. M.—Lower 4 inches of rectum covered with bands of cicatricial tissue much contracted	4½ *months.*	17
ctal fæcal fistula	Rapidly convalesced. No fæces passed after operation through rectum. Died of ruptured heart. P. M.—Rectum healed; old fistula into bladder small	5½ *years.*	18
al fibrous polypoid growths of 3 ing. Had had polypi removed . Great tenesmus and discharge d serum. At once relieved by n	Convalesced, and died from pneumonia	41 *months.*	19
struction for 6 weeks. Opera- life. Case, one of *volvulus* in ty	Convalesced	4 *years,* alive and well.	20
ivic tumour occluding rectum r obstructing rectum (cancer-	Sank from the disease relieved Relieved by operation. Died from ruptured cancerous mesenteric tumour	7 *weeks.* 4 *days.*	21 22

verage age of *19 cases 40 years*—of females 35, of males 45. All operations on left loin. *hin the month; 5 within 6 months;* 4 lived respectively 1 year, 3, 3½, and 5½ years. Four *and well 1½, 2½, 4 years, and* 14 years after the operation.

ANALYSIS OF THE WHOLE NUMBER OF EIGHTY-TWO CASES OF COLOTOMY.

60 were performed for cancerous stricture.
19 „ „ stricture and ulceration of the rectum not cancerous.
1 was performed for volvulus of the sigmoid flexure of the colon.
2 for obstruction due to pelvic tumours.

Side operated upon—

Left lumbar colotomy was performed in 77, and right lumbar colotomy in 5 of these cases, all of the five being cancerous. Right lumbar colotomy was called for in 1 out of 12 cases of cancerous stricture.

Duration of life after the operation—

26, or 43 per cent. of the cancerous, and 6, or 31·5 per cent. of the non-cancerous cases, with one of the cases operated upon for obstruction, or 40 per cent. of the whole number of 82 cases operated upon died within the month.

34, or 56 per cent. of the cancerous, and 13, or 68·5 per cent. of the non-cancerous cases, with the case of volvulus and one of the cases of obstruction, or 60 per cent. of the whole number of cases operated upon, received more or less fully the benefit of the operation.

Of the 49 successful cases—

16	cases,	9	cancerous and	7	non-cancerous, died within 6 months.
8	„	7	„	1	„ lived from 6 to 12 months.
12	„	9	„	3	„ lived from 1 to 5½ years.
5	„	1	„	4	„ were alive from 1½ to 14 years after operation.
8	„	8	„		had left the hospital convalescent.
49		34		15	

Sex—

Of the 60 cancerous cases:	40 were in males,	20	in females.
„ 19 non-cancerous:	10 „	9	„
1 case of volvulus:	1 was in male.		
2 cases of obstruction:	1 „	1	in female.
Of the 82 cases:	52 were in males,	30	in females.

Cancerous stricture is more frequent in males. Non-cancerous stricture is found equally in both sexes.

Age—

The average age of the cancerous cases,
When fatal was 53: in male subjects 54, in female 51.
„ successful 44 „ 46 „ 41.

The average age of the successful being about 10 years less than that of the fatal cases.

No abnormality as to the position of the colon was met with in any of the 82 cases.

Summary.

By way of summary, therefore, it may be stated that—

Laparotomy is an operation which should be performed in all cases of acute intestinal obstruction due to bands, internal hernia, and intussusception, that do not speedily yield to other treatment.

Lumbar Colectomy should be performed when the stricture in the large intestine is annular, localised and moveable.

Colotomy is applicable to cases of obstruction to the large intestine from stricture, or the mechanical pressure of tumours that cannot be relieved by other means.

Enterotomy affords a means of relief for all other cases of intestinal obstruction to which the two former operations are inapplicable, and more particularly when the small intestines are involved.

Excision of the Pylorus.

This operation was first performed for cancer by Péan, of Paris, in 1879, and Billroth, Wölfler, Nicolaysen, Czerny, Southam, and others, have repeated it with enough success to justify its repetition in cases in which the diagnosis is tolerably certain, and the disease moveable. Full details of this difficult and dangerous proceeding are to be found in Billroth's 'Clinical Surgery,' published by the New Sydenham Society, 1882.

On Tapping the Intestine.

On tapping the intestine.

Arguments in favour.

The practice of tapping the intestine with a fine trocar and canula in cases of intestinal obstruction, is one which deserves serious consideration, since there is good reason to believe that a small puncture may often be made into a distended intestine, and wind drawn off without any extravasation of the contents of the bowel taking place; and that if the distension of the strangulated, twisted, or otherwise obstructed bowel can be relieved by the operation, there is some ground for hope that natural efforts may then release the bowel from beneath its band, or from some internal peritoneal ring, and that even a twisted bowel may untwist. The operation, however, is not without its risk, as I have on several occasions known fæcal extravasation to follow the practice, and Coupland and Morris quote other cases. I have been also led to believe that even in a large hernia, its strangulation might be relieved by a like operation, and a natural reduction take place; for a strangulated bowel, outside as well as inside the abdominal cavity, is damaged by the distension of the intestine itself, more than from any extra-intestinal influence, and if this distension can be relieved by simply drawing off the contents of the bowel by means of a very fine trocar and canula, the walls of the intestine would collapse, strangulation cease, and unless adhesions confined the bowel in its position, its return might be looked for by natural efforts. These remarks are based upon the fact that intestine may be so treated without any extravasation following, and such a result actually came before me in a case of ileo-colic scrotal hernia, in a gentleman æt. 76, when, to enable me to reduce the bowel, I was driven to puncture the protruding intestine in four or five places, and although much manipulation followed this practice, no extravasation occurred at the time or after, and a rapid recovery ensued without a drop of suppuration. The case occurred in the practice of Mr. Kelson Wright, of Kennington. These remarks are only to be read as suggestions, and more particularly as applied to large umbilical and scrotal herniæ. Since the introduction of the pneumatic aspirator by Dr. Dieulafoy, this practice has received much

Case in which it was performed.

encouragement. For more detailed evidence on the subject of intestinal obstruction and its treatment, the following papers may be referred to:

Brinton, 'Croonian Lectures,' 1859.—*Fagge*, 'Guy's Reports,' 1868.—*Gay*, 'Trans. Lond. Med. Soc.,' 1861, 1862.—*Gorham*, 'Guy's Reports,' vol. iii, series 1.—*Hinton*, 'Association Med. Journal,' 1853.—*Smith*, 'American Journal of Med. Science,' 1861.—*Bryant*, 'Med Times,' 1872.—'A Treatise on the Pneumatic Aspiration of Morbid Fluids,' by *Dr. George Dieulafoy*, 1873.—*Trousseau's* 'Clinical Medicine.'—*Hutchinson*, 'Med. Chir. Trans.,' vol. lvii, 1874.—*Coupland* and *Morris*, 'Brit. Med. Journ.,' Jan. 26th, 1878.—*Bryant*, 'Lancet,' May, 1878.—'Clinical Society,' 1878.—'Med.-Chir. Trans.,' 1882.

On Tapping the Abdomen.

Paracentesis of abdomen.

Whenever fluid collects in the abdominal cavity so as to interfere with life's functions, the operation of tapping may be called for. It may be for *ascites*, a collection of fluid in the peritoneal cavity; for *ovarian dropsy*, a collection of fluid in a single or in a polycystic tumour; or for *hydatid*, whether hepatic, pelvic, or peritoneal. It may also be called for in *renal* or *splenic* cysts.

It would be out of my province to enter minutely into the diagnosis of all these conditions, as the majority of such cases come under the care of the Physician, the Surgeon being called in simply to operate. Nevertheless, it may be as well to give some of the leading points of diagnosis, for I need scarcely say that the operating Surgeon is not relieved of all responsibility of diagnosis by the fact that a medical mind has charge of the case. The operator, as such, assumes part, at least, of the responsibility of the case as well as of the operation.

Diagnosis previous to tapping.

Ascites.

Diagnosis.—In a general way it may be asserted, therefore, that *ascites* is the result of a chronic action that has been going on for some time, arising from liver, peritoneal, heart, or renal disease, the abdominal dropsy being one of the results only. The history of the case, consequently, will be a great help in arriving at a conclusion. The fluid, moreover, will be found to fill the abdominal cavity equally; fluctuation being perceptible across the abdomen, and from before backwards well into the loins, even when the abdomen is resonant. As a rule, the intestines will be found floating upwards, thus giving resonance on percussion, the position of the bowels being influenced by that of the patient. With the body horizontal, they will give resonance at the umbilicus; with the pelvis depressed, above this point; with the pelvis well raised, resonance may even be detected near the pubes. In almost all these cases the sound over the loins will be dull. On looking at the abdomen, the surface will be smooth and the enlargement equal. The subject of diagnosis of ovarian and uterine disease will receive attention in Chapter XXVII.

The Operation.

Description of the operation of tapping.

The instruments required for the operation are a moderate-sized trocar and canula; an India-rubber tube about six feet long, adapted to a silver-tubular plug that fits the canula when the trocar is removed; a lancet or small scalpel; a pad of lint; and a roll of good strapping.

Some Surgeons prefer one of the modern instruments by which the india-rubber tube is attached to the canula at right angles, and they are very good; but those I have named are efficient.

Position of patient.

The patient should be brought to the edge of the bed and placed in the recumbent position, with the shoulders raised; a folded sheet or piece of mackintosh cloth having been previously so arranged as to

protect the sheets. A catheter should first be passed, then with the trocar and canula warmed and oiled, and a pail at hand into which the end of the india-rubber tube is allowed to hang, the Surgeon may with a lancet make a small incision through the skin and soft parts, about three inches below the umbilicus, or at any other spot at which the operation is to be performed. He should next introduce the trocar and canula with a direct force and semi-rotatory movement of the wrist, and, with his forefinger fixed about one inch from the end of the canula, guard against inserting the trocar too far. The abdomen having been punctured, the trocar may be removed with the right hand, the canula being pushed further in at the same moment with the thumb, and its orifice plugged at once with the left thumb, to prevent the escape of fluid. The silver plug of the india-rubber tube may then be introduced and the fluid allowed to escape, the distal end of the tube being kept submerged in the fluid in the receptacle; the tube acting as a syphon. Details of operation.

To facilitate the flow and to evacuate the whole contents of the cavity, some surgeons roll the patient over on the side, or place him so at the first; but such a proceeding is unnecessary.

When the fluid has ceased to flow, the canula is to be gently removed, the thumb and finger of the left hand nipping up the soft parts as its end appears, so as to prevent the admission of air into the abdominal cavity, and the trickling of any fluid down the patient. The edges of the wound may then be adapted by a piece of good strapping, and a pad of lint applied when oozing appears, but not otherwise; two or three bands of strapping, three inches wide, should then be adjusted to the front of the abdomen from side to side. Where great hollowness is left, a pad of cotton wool often gives comfort. The old-fashioned flannel bandage may be abolished, as it is only an inconvenience. Mode of finishing the operation.

All pressure on the abdomen during the flow of the fluid should be avoided as unnecessary, and also all pressure after the operation; support only being required.

The usual place to perform the operation is in the linea alba, about two or three inches below the umbilicus; but in ovarian disease any point in the linea semilunaris may be opened, and in rare cases any other. Site of the operation.

When a hydatid, renal or splenic cyst requires to be tapped a small trocar and canula, such as is employed for tapping a hydrocele, should be used; though in these cases, the Pneumatic Aspirator is of great service, for by its use the fluid can be removed without the possibility of air being introduced. Use of aspirator.

Hydatid Tumours

of the liver, spleen, or other parts of the abdomen are occasionally met with, and, however large a size they attain they rarely produce other symptoms than those mechanically caused by their size, and on that account they may require treatment. Their origin is indicated by their position, although when situated in the pelvis, there may be an impossibility in diagnosing them from ovarian cysts. They are almost always very globular and tense, and rarely give rise to distinct fluctuation. Hydatid abdominal tumours.

The external feel of a hydatid is somewhat peculiar and characteristic. In 1868, I removed with permanent success, an enormous hydatid tumour from the abdomen, although apparently not from its cavity, *of a lady patient* of Dr. Oldham, æt. 35, who was believed to Diagnosis of hydatid tumours.

have had ovarian disease ('Guy's Hosp. Rep.,' 1868), while Sir Spencer Wells records a case in which the hydatids were turned out of the abdominal cavity. Sometimes the hydatid dies without surgical interference, and, as a consequence, severe suppuration is set up with violent constitutional disturbance, which requires surgical aid.

Treatment when suppurating.

Not long since I opened, with marked success, a large abscess over the liver of a boy æt. 17, and evacuated a quantity of pus, bearing the peculiar odour of hydatid pus. The abscess clearly came from the liver, and was a suppurating hydatid. The boy previously had suffered from tapeworms. In 1869, I had to open freely a suppurating hydatid tumour, which half filled the abdomen of a gentleman, æt. 40, who had had it tapped some months before in Australia, and a complete recovery ensued. A quantity of dead hydatid cysts escaped through a large canula that was introduced. The cyst was washed out daily with great benefit. This gentleman is now quite well. I have had at least ten other cases in which a like treatment was employed with success, nor have I lost one, although several have had a very narrow escape. The secret of the treatment of suppurating hydatid cysts consists in a free outlet for all purulent and dead hydatid deposits, and the frequent washing out of the suppurating cavity with water containing iodine, Condy's fluid, carbolic acid, or creosote, with or without the introduction of a drainage-tube or elastic catheter. For the operation, a large trocar and canula should be employed—the canula being left in for some days until a good opening is established; it may then be exchanged for an elastic catheter or large drainage-tube.

Before suppuration.

Before suppuration takes place, however, other treatment is applicable, such as draining off partially or wholly the fluid contents of the hydatid by means of a very fine trocar and canula. I have performed this operation on many occasions with success, but generally prefer to draw off only a few ounces of the fluid; clinical experience indicating that by this measure alone the hydatid may be killed, subsequently withering up and ceasing to hurt. Dr. J. Miller, of Tasmania, where this disease is frequent, speaks highly of the use of twenty-grain doses of the bromide of potassium three times a day after the tapping, and Dr. Bird, of Melbourne, combines with it drachm doses of the tincture of kamela. At times, also, cases which have been looked upon as cured are not so, and, after the lapse of years the disease re-appears. When suppuration follows tapping, however, a cure ensues.

Case of sudden death after tapping.

The operation of simply tapping a hydatid with even the finest instruments is not, however, free from danger, for in January, 1877, I tapped a man æt. 42, who, with the exception of the hydatid tumour of the liver, was in perfect health, and drew off half a pint of hydatid fluid, having to perforate the structure of the liver to the depth of an inch to reach the cyst. The operation was not attended by the slightest distress; but on the removal of the needle an agonizing pain attacked the man's face and jaws, accompanied with flushing of the head and neck. This was followed by vomiting, extreme pallor, and stertorous breathing for a minute, followed by death in two minutes. At the necropsy nothing was found to account for this sudden end, that is, there was no embolism or heart trouble, no brain disease, nothing but a large hydatid cyst behind the liver. The needle had, however, passed through a misplaced portal vein on its way to the hydatid, and the question arose as

to the possibility of death being due to the mixing of the hydatid fluid with the venous blood. No blood was extravasated (Clin. Society, 1878). My colleagues, Dr. Fagge and Mr. Durham, have given us some evidence that a cure can be obtained by electrolytic treatment, on Dr. Althaus's plan of introducing into the tumour two electrolytic needles, one or two inches apart, connected by means of wire to the negative pole of a galvanic battery of ten cells, and completing the current through the tumour by means of a moistened sponge attached to the positive pole of the battery, applied for ten or more minutes at a time to different points over the swelling. ('Med.-Chir. Trans.,' vol. liv.) This operation may be repeated according to circumstances. Electrolysis.

Such treatment may be employed when simple tapping fails to cure. Some of the patients reported as cured by these means have returned, however, with the disease, and it is still a question whether more is gained by this method than by simple puncture, and the withdrawal of some of the hydatid fluid.

Further information may be gained from Murchison's work on the liver, 1868, Harley's paper, 'Med.-Chir. Trans.,' vol. xlix, and Dr. Bird, of Melbourne's, book.

Tumours of the Umbilicus.

Pedunculated outgrowths from the umbilicus are not uncommon, and always found in children, being composed of simple granulation tissue; indeed, it seems probable that they are really due to excess of granulation growth from the point at which the umbilical cord separated. They sometimes attain a large size, and have occasionally a slight central canal or orifice, though the former never travels far. I have seen one the size of the last joint of my little finger. They are easily cured by the application of a ligature to their bases. Pedunculated umbilical growths.

These tumours, however, must not be confounded with a condition that is occasionally met with, viz. the presence of a fleshy outgrowth not unlike a glans penis, through which a real canal extends into the bladder, the canal being clearly an open urachus. I have seen two such cases, one I recorded in my Lettsomian lectures on the surgical diseases of children, 1863. I wished to cauterise the surface of the canal, and thus cause its contraction and closure, but was not allowed. Patent urachus.

I have also seen a large hernial protrusion appear at the umbilicus, with the whole surface ulcerated, in which there were some solid contents, which I took to be the liver. It subsequently completely cicatrised, and a good recovery ensued. The drawing of this case is in Guy's Hospital Museum (*vide* Fig. 285). Ulcerated hernial protrusion.

Sebaceous tumours, as well as accumulations of sebaceous matter, are also met with at the umbilicus in dirty people. I have turned out large masses of such indurated secretion from the cup-like depression. Sebaceous deposits.

Cancerous tumours, &c., as well as simple warty growths and syphilitic condylomata, may also exist in the same position. Cancerous, warty, and syphilitic tumours.

CHAPTER XV.

HERNIA.

Diagrams illustrating the different forms of Hernia, with some of its complications.

In all these diagrams the thick black line represents the parietes covering in the hernial sac; the thin line the peritoneum and hernial sac; the small body at the bottom of the sac the testicle.

Fig. 261.



Fig. 261.—This diagram illustrates the tubular vaginal process of peritoneum open down to the testicle, into which a hernia may descend. When the descent occurs at birth the hernia is called "congenital;" when at a later period of life the "congenital form," Birkett's "hernia into the vaginal process of peritoneum," or Malgaigne's "hernia of infancy."

Fig. 262.



Fig. 262.—The same process of peritoneum open half way down the cord, into which a hernia may descend at birth, or at a later period. Birkett's "hernia into the funicular portion of the vaginal process of the peritoneum."

Fig. 263.



Fig. 263.—The same process undergoing natural contraction above the testicle, explaining the hour-glass contraction met with in the congenital form of scrotal hernia, as well as in hydrocele.

Fig. 264.



Fig. 264.—Diagram showing the formation of the "acquired congenital form of hernia," the "encysted of Sir A. Cooper," "the infantile of Hey," the acquired hernial sac being pushed into the open tunica vaginalis which encloses it.

Fig. 265.

65.—Diagram illustrating the forma-
he "acquired" hernial sac, distinct
testicle or vaginal process of perito-
ich has closed.



Fig. 266.

66.—Illustrates the neck of the her-
pushed back beneath the abdominal
with the strangulated bowel. (*Vide*
.) Bell's form.



Second variety of displaced hernia.

Fig. 267.

67.—Shows the space in the subperi-
onnective tissue, into which intestine
pushed through a rupture in the neck
ernnial sac, the intestine being still
ated by the neck. (*Vide* Fig. 280.)



Third variety of displaced hernia.

Fig. 268.

68.—Diagram showing how the neck
aginal process may be so stretched into
ced between the tissues of the abdomi-
either upwards or downwards between
and muscles—muscles themselves or
the muscles and the internal abdomi-
ia—forming the intra-parietal, inter-
r, or interstitial sac; hernia *en bissac*
rench; "additional sac" of Birkett.
ig. 281.)



Fourth variety of displaced hernia.

Fig. 269.

69.—Diagram illustrating the reduc-
the sac of a hernia *en masse* with the
ated intestine.



First variety of displaced hernia.

ABDOMINAL HERNIA.

On hernia.

Abdominal hernia or rupture signifies the protrusion of any viscus through an opening in the parietes of the abdominal cavity. This

Situation.

protrusion for the most part occurs at the *inguinal* and *femoral* canals or *umbilicus*, though occasionally at other parts when the abdominal walls have been weakened by some inflammatory lesion, rupture, or division of muscle from injury or operation, and more rarely at such weak points of the abdominal walls as the obturator foramen, the perineum, the ischiatic notch, the diaphragm, or the vagina.

Class of society.

It is met with in subjects of every social condition, but most frequently amongst the so-called working classes, because "hernia occurs oftenest in the most numerous classes, and not in the most laborious."

Kingdon, 'Med.-Chir. Trans.,' 1864.

Agnew tells us that in the American war 50 out of 1000 recruits were rejected on account of rupture; that in Germany the proportion was 82; in France 65; in England 39; in Ireland 36; in Italy 76.

Hereditary tendency.

Hereditary predisposition to hernia is also doubtless a reality, since a third of all cases acknowledge a history of having a parent with rupture, and such predisposition probably exists as a general laxity of the mesenteric folds and parietal layer of peritoneum. I have been called upon to operate on an old gentleman, the male branches of whose family for four generations—twelve in all—have been ruptured. Inguinal hernia is often due to a failure in the natural closure of the sheath of peritoneum that travels down with the descending testicle, which failure is more common on the right side.

Subjects who are congenitally feeble, and others who become weak from illness or old age, are more liable to hernia than the robust, the weakness of the abdominal parietes yielding to the natural pressure of the abdominal contents under the influence of some sudden or prolonged muscular exertion. A large number of the cases of hernia are slow in their development, many are sudden, and in all muscular exertion plays an important part.

Proportion as to its seat.

Out of every 100 cases of hernia 84 are *inguinal*, 10 *femoral*, and 5 *umbilical*. It is more common in males than females, in the proportion of 4 to 1; 18,492 females only having been applicants for trusses at the Truss Society, out of the total of 96,886 ('Report,' 1871).

Hernia in females.

Females are as liable to inguinal as they are to femoral hernia, to the inguinal in early life from the canal of Nuck being open; to the femoral in middle and old age. In females under 20 years of age there are 87 cases of inguinal to 13 of femoral hernia; and after 40 years there are 32 cases of inguinal to 68 of femoral. The largest number of cases of femoral hernia are developed during the child-bearing period of a woman's life, that is, between 20 and 40 years of age. Prior to menstruation it is so rare as to be almost unknown. Kingdon gives only four such cases.

Hernia in males.

In males *inguinal* hernia is the usual form, Kingdon's table showing that the largest number of cases occur during the first ten years of life, from a want of closure of the vaginal process of peritoneum that covers the spermatic cord. It is about half as frequent between the ages of 10 and 20 years, while between 20 and 40 it is as common as it is at the early period of life, but its frequency rapidly diminishes after that period.

Femoral hernia occurs in the male about 4 in every 100, though it becomes, as in the female, relatively more common than inguinal as age advances. During the first ten years of life it is not met with more frequently than 1 in 300; whilst between the ages of 10 and 20, 2 per cent. are femoral; between 21 and 40, 4½ per cent.; between 41 and 60, 6 per cent.; and above 60, nearly 8 per cent.

Average age when strangulated.

The average age of persons suffering from *strangulated inguinal* hernia is 43, but from femoral 55. A hernia that becomes strangulated in its first descent is far more acute and fatal than that which has been of long standing, and a femoral hernia is more liable to become so strangulated than an inginual in the proportion of 3 to 1. These "recent cases" of femoral hernia mostly occur in old women about 60 years of age, and of inguinal in young men, the hernia being in the latter of the "congenital kind."

Anatomy of a Hernia.

Anatomy of a hernia.

A *hernial tumour*, with few exceptions, is composed of a *sac* with its *contents* and the soft parts covering it.

The *sac*, which is made up of peritoneum, is formed in two ways, *firstly*, by the gradual stretching and pouching of this membrane through an opening in the abdominal parietes by the protruding viscera, and, being artificial, has been well named by Birkett the *acquired hernial sac*, this variety being common to all forms of hernia; and, *secondly*, of the open vaginal tubular process of peritoneum, formed by the descent of the testicle—the opening that normally exists in fœtal life not having closed owing to some deficiency in the obliterating process, that naturally commences at the internal ring and proceeds downwards towards the testis in the scrotum. This variety—equally well named the *congenital hernial sac*—being only found in inguinal hernia.

Acquired hernial sac.

Congenital hernial sac.

The formation of the hernia in the former case is a gradual, but in the latter a rapid process, the "acquired" hernia being an affection of middle and old age, the "congenital form" usually one of infancy or young adult life.

The sac also is composed of a body and a neck, which communicates by a mouth with the abdominal cavity. When the hernia is small, the neck and body appear as a small pouch, into and out of which the hernial contents pass with facility; the sac having no narrow neck by which the return of the intestine can be retarded. But when the hernial sac is large, and has escaped into looser tissues, its body or fundus so expands as to render by comparison the neck of the sac a narrow canal or orifice, when the return of the hernial contents often becomes one of difficulty; indeed, it is under these circumstances that it frequently becomes strangulated.

Changes in the neck of hernial sac.

The neck of the sac also undergoes changes which it is essential to understand, particularly in cases of scrotal hernia, where the peritoneum is so forced outwards through the inguinal ring as to fall into puckered folds.

These folds will disappear, however, if the hernia and sac be reduced into the abdominal cavity, or the constricting ring of tissue external to it be divided, the degree of unfolding of the neck of the sac being regulated by the amount of expansion of which it is capable. But

should the sac be neither returned nor its constricting ring of outside tissue divided, the puckered folds of peritoneum will adhere, and probably the subperitoneal connective tissue will unite with it; the neck of the sac, under these circumstances, becomes indurated and thickened, and, as time progresses, contracts; as a consequence, a narrowing and rigidity of the neck of the sac ensues, which necessitates, in old inguinal hernia, when an operation for strangulation is required, the opening of the sac and a free division of its neck.

Absence of sac. When a hernia forms at the seat of a wound in the abdominal wall, there is no sac, and the same occurs when the cæcum or colon protrudes through the inguinal canal.

Contents of hernia. The *contents* of a hernia are usually small intestine and omentum, a portion of the last two feet of ileum being, as a rule, involved; the cæcum and colon also are occasionally so, and cases are on record in which the bladder, stomach, ovary, or gall-bladder has been found in the sac.

Omental sac. At times the omentum is so pushed before the intestine as to cover it completely, thus forming an inner sac; the bowel, as a rule, however, lies behind the omentum.

Varieties. When intestine protrudes, the hernia is called an "*enterocele*"; when omentum, "*epiplocele*"; when both intestine and omentum occupy the sac, "*entero-epiplocele*"; when bladder, "*cystocele*"; when stomach, "*gastrocele*," &c. &c.

Soft parts covering hernial sac. *The tissues that cover in a hernial sac* will necessarily depend upon the seat of the hernia. Thus, in the *umbilical*, it may be only the membrane of the cord, skin, and abdominal fascia; in the *scrotal* it will be the scrotal tissues; in the *femoral*, the skin with the superficial and deep fasciæ; but in all, and more particularly in the femoral, the Surgeon should bear in mind the anatomical fact, that a layer of fascia —which lines the abdominal muscles and separates them from the peritoneum—covers in the true peritoneal sac, and is known as the "fascia propria" of Sir A. Cooper, and between this fascia and sac some subperitoneal fat often exists.

Reducible, irreducible, and strangulated. When a hernia comes down into a sac and goes up again, either by itself or aided by position or by the Surgeon, it is called "*reducible*"; when it cannot be returned it is called "*irreducible*"; when it is constricted sufficiently to interfere with the return of the contents of the protruding viscera, it is known as "*incarcerated*," but would be better called "*obstructed*," and when in addition the circulation of the part is interfered with, it is said to be "*strangulated*."

When the protrusion takes place *above* Poupart's ligament, through the internal ring, but does not traverse the canal sufficiently far to

Bubonocele. appear through the external ring, the hernia is called a "*bubonocele*" (*vide* right side of Fig. 270); when it protrudes through the external

Scrotal. ring into the scrotum, a "*scrotal hernia*" (*vide* left side of Fig. 270), both forms being included in the term "*oblique inguinal hernia*."

Direct inguinal. When a hernia makes it way directly through the external ring without having passed down the inguinal canal, it is called a "*direct inguinal*" (Fig. 271).

Femoral. A *crural* or *femoral hernia* is *below* Poupart's ligament, the protrusion having come down through the crural ring on the inner side of the sheath of the femoral vessels (Fig. 272).

Umbilical. An *umbilical* hernia or exomphalos is a protrusion at the navel. A

a protrusion at any other part of the abdomen. The names ther form are according to the locality.

Fig. 270.



IQUE INGUINAL HERNIA.
on right side, but passing through external ring on left.

Fig. 271.



DIRECT INGUINAL HERNIA.

ms.—A hernia in its early stage may show itself as a mere Symptoms of hernia.
out the internal inguinal ring, the crural ring, or other open- Fulness at ring.
fulness becoming very manifest on the patient standing and
The patient's attention
ably been drawn to the
feeling of *weakness* on
xertion, or, in perform-
natural act demanding
action of the abdominal
With this weakness there
associated some griping
pain or feeling of un-
wrongly attributed to
on — and in old people
mptoms should always
he notice of the Sur-

Fig. 272.



Tumour.

FEMORAL HERNIA.

hernial pouch increases
ur in the inguinal canal,
moral ring or umbilicus,
itself as a distinct
this being manifest when the patient stands or coughs, Impulse on coughing.
pearing on his lying down. It will, moreover, be prevented
rning on the patient assuming the erect posture, if the finger of
on is placed over the ring. The swelling always comes from
travels downward. As the tumour still further increases a
pulse will be felt by the hand when placed over it if the patient
d a peculiar gurgling sound will be heard on the application Gurgling.

of pressure to the part to cause its reduction. The return of the bowel also into the abdominal cavity will be marked by the disappearance with a jerk of the contents of the sac, and a distinct appreciation by the finger of the aperture through which it has passed.

Capable of being replaced.

Diagnosis of contents.

"If the surface of the tumour be uniform, if it be elastic to the touch, if it become tense and enlarged when the patient is troubled with wind, holds his breath or coughs; if in the latter case it feels as if it were inflated, if the part return with a peculiar noise and pass through the opening at once, the contents of the swelling are *intestine*. If the tumour be compressible, if it feel flabby and uneven on the surface, if it be free from tension under the circumstances just enumerated, if it return without a noise and pass up gradually, the case may be considered as *epiplocele*. If a portion of the contents slip up quickly and with noise, leaving behind something which is less easily reduced, the case is probably an *entero-epiplocele*." (Lawrence.)

Hernia of infants.

In infants where Malgaigne's "hernia of infants" exists (Fig. 261), or Haller's "hernia congenita," both being caused by the descent of intestine into the open vaginal process of the peritoneum, the tumour is very often large when first discovered and often scrotal. In young adults, where the same kind of hernia exists, the swelling comes suddenly and at once, by one rush downwards into the scrotum, this rush being accompanied with pain.

Treatment.

In all these forms of hernia, when reducible, either the *palliative* plan of treatment may be employed, or what is known by the *radical cure*.

Palliative use of truss.

The palliative treatment consists in the application of a *truss*—an instrument composed of a pad or cushion, connected with a metallic spring or with straps, and so arranged that the pressure of the pad keeps the hernia from descending; the spring maintains the pad in position, and at the same time allows perfect freedom of movement of the body. Any truss that accomplishes this is beneficial, but any that fails in this is worse than useless, as it is injurious, and gives false confidence.

The operation for the *radical cure* of hernia will be considered under the heading "Inguinal hernia."

Hydrocele of the Hernial Sac

Hydrocele of hernial sac.

is a very rare affection, and not more than six cases are on record. I have seen but one true example of it, that is, if the term be confined to such cases of accumulation of fluid in the hernial sac in which the neck of the sac is occluded by some adherent omentum or intestine, or by the radical cure. The case occurred in a man æt. 40, who had been treated for hydrocele of the right testicle for twenty years, and had frequently been tapped. He came under my care with a right scrotal swelling which extended up to the internal ring, and obscure symptoms of intestinal obstruction. He was tapped and serous fluid was drawn off, but the symptoms continued. After the lapse of two or three days, as the abdominal symptoms increased in severity in my absence, an exploratory operation was performed, and a mass of what was supposed to be omentum or an omental sac containing intestine was found blocking up the internal ring. This was opened and the mucous membrane of the bowel exposed. The opening into the bowel was stitched up, but the symptoms persisted, and the man died

Case.

two days later of peritonitis. An examination after death showed, that what had been regarded as an hydrocele was a dropsy of a congenital hernial sac, and what had been opened as a mass of omentum or omental sac was a knuckle of ileum matted together and to the neck of the sac by lymph—this adhesion giving rise to the fatal obstruction. No hydrocele existed. Such cases as these should not be mistaken for dropsy or suppuration of the hernial sac after herniotomy, which are by no means unfrequent conditions, and should be treated by tapping, or, a free incision. Dropsy of sac after herniotomy.

Irreducible Hernia.

When the contents of a hernial tumour cannot be returned into the abdominal cavity, an irreducible hernia is said to exist, and this condition may be temporary, brought about by anything that alters the relations between the bulk of the tumour and the neck of the sac, or the opening through which they would have to return, such as some excess of fæces or flatus in the part, or some fresh descent of omentum or bowel. A hernia may be made permanently irreducible by adhesions between the sac itself and its contents; by bands traversing the sac, or by adhesions between the intestine and some fold of omentum. In long standing herniæ the same result will ensue from the development of fat in the omentum. On irreducible hernia.

The tonic or spasmodic contraction of the structures outside the neck of the sac under the influence of irritation, as well as the induration of the neck of the sac itself, or of the surrounding parts, have also an important influence in preventing the reduction of the tumour.

When the cæcum or large intestine forms the contents of the hernia, the rupture may be irreducible, from the fact that the peritoneum, which is naturally adherent to these parts, and is dragged down with them, becomes fixed to the tissues into which it is protruded. A cæcal hernia is, however, always difficult of reduction. In one case I had to puncture the bowel with a trocar and canula, and draw off the air it contained before I succeeded. No harm followed this step, and the patient did well, but the measure is not without its dangers. Cæcal hernia.

An irreducible hernia is always a source of anxiety and danger, because when composed of omentum a piece of intestine may at any time slip down behind it, and become caught in one of its folds; and, when composed of omentum and intestine, any accumulation of the contents of the bowel within the hernial sac may give rise to obstruction, and then strangulation of the hernia is not distant. An irreducible hernia, moreover, is always liable to injury. Prognosis.

An irreducible scrotal or even femoral hernia will sometimes attain a large size. I have seen examples of both reaching half way down the thigh, but umbilical hernia will sometimes attain a still greater size. May become large.

These forms of hernia often give rise to dyspeptic symptoms, to irregularity of bowels and colicky pains, but the chief danger lies in their tendency to become strangulated.

TREATMENT.—A large irreducible *entero-epiplocele* must be treated by a bag truss; that is, with an instrument so adapted as to support the hernia, and prevent as far as possible its increase. A small irreducible umbilical, inguinal, or femoral hernia ought to be treated by a hollow truss, the only reliable pad being one moulded upon a plaster cast of the hernia, taken when the tumour is at its smallest, after a Treatment.

day's rest. The pad should be made of metal moulded to the cast, lined with wash leather, Fig. 272A (*vide* paper by Author, 'British M cal Journal,' February 16th, 1884). An *omental* hernia should be tre

FIG. 272A.



Drawing showing on the *right* side a truss fitted to an irreducible hernia, in whic pad has been moulded upon a cast of the patient's groin; and on the *left* s irreducible hernia, with the hollow of the pad exposed to view, prepare application.

Bag-truss.

by a truss, made in the way described upon a cast. Every patient an irreducible hernia should be warned against taking violent exe or over-distending the abdominal viscera. The bowels should nev allowed to become constipated, and, above all, the slightest sympto pain or increase of size in the tumour should be brought at once u medical advice, since these irreducible herniæ are treacherous th and become obstructed and strangulated very insidiously.

A reducible hernia may become irreducible.

In many cases of irreducible hernia, and particularly in recent reduction may be effected by rest in the horizontal posture, a purge or enema, and the administration of small doses of saline p tives, such as the sulphate of magnesia, so as to keep up a gentle a

Use of ice.

of the bowels, with the *local application of ice*, the diet being a same time nutritious, though not of a bulky nature. In this way I

Example.

procured the reduction of cases of hernia that had been down for months; in several cases I have succeeded after three weeks' treatm Old irreducible herniæ are, however, rarely made reducible by treatm but the not very old examples and the recent can generally be reducible by the means already indicated.

Obstructed or Incarcerated Hernia.

Obstructed hernia.

Symptoms.

The *symptoms of an obstructed hernia*, as of obstructed intes are not very definite, but the chief are, obscure abdominal pains w dragging sensation about the umbilicus after food, nausea, and

Constitutional.

times, vomiting. Constipation, when present, aggravates the s

Local.

ptoms, and renders the local signs of obstructed hernia more ma

the tumour becoming distended, tympanitic, and painful. On manipulation, the intestine in the hernia may be partially or wholly emptied of its gaseous if not of its solid contents, and the compression of the tumour be accompanied by the peculiar gurgling sound of gas and fluid as these traverse the canal towards the abdominal cavity. When such symptoms are chronic, they are generally known as indicating an *incarcerated hernia*, but such a term is not satisfactory, it being applied to the obstructed as well as to the reducible hernia, and should be discontinued. When chronic.

Treatment. Treatment.—These cases require great care in their treatment, because, if neglected, they pass on rapidly to inflammation or strangulation. *Rest* in the horizontal position is of primary importance, and the tumour, if scrotal, should be slightly elevated. *Warmth* to the hernia, also, often gives comfort, relaxing the parts, and thus favouring reduction. Rest. Warmth.

When constipation, *unaccompanied by vomiting*, exists, a brisk purge may be given, but with this symptom a purgative enema is to be preferred, the natural action of the bowels being stimulated by these means, and the contents of the hernial sac moved on. The tumour itself should not be manipulated at this stage of the case, such a step doing harm by bruising or setting up inflammatory action. When success does not attend these efforts and the symptoms persist, the source of obstruction will have to be sought by the Surgeon, as it will probably be mechanical, and the case have to be dealt with as one of strangulated hernia. Use of purgatives. Avoid manipulation.

Inflammation of a Hernia.

An inflamed is not a strangulated hernia. Inflammation of a hernia is generally the result of some injury to an irreducible hernia, either from accident, a badly-fitting truss, or ill-advised manipulation. An irreducible hernia after an attack of obstruction may inflame. A reducible hernia becoming temporarily irreducible and inflaming, may become permanently irreducible by adhesions forming between the sac and its contents. An inflamed hernia. Causes.

The local *signs* of an inflamed hernia are pain, swelling, and induration. When the tumour contains omentum it becomes nodulated and irregularly hard; and when intestine, much fluid will be poured into the sac. When the action is enough to interfere with the natural function of the tube, symptoms of general peritonitis or obstruction will appear, which must be dealt with on ordinary principles. Local signs.

Treatment. Treatment.—*Rest* and the *local application of ice* in a bag are the most important remedies, also *purgatives* when obstruction in the hernia does not exist, and opium when it does. By such means the symptoms are generally arrested; and when this result does not take place the case passes on to one of obstruction, if not of general peritonitis.

Rupture of a Hernia,

Rupture of hernia. or rather of the sac and integuments over it, has been recorded by B. Pitts, of St. Thomas's Hospital ('Lancet,' April 7, 1883), and the accident, as proved by the case, is not necessarily fatal. It occurred in a woman, æt. 46, who had been operated upon for a strangulated *femoral* hernia 2¼ years previously. She had not worn a truss for a year before the accident, and the hernia had become as large

as a child's head. It burst during a fit of coughing, and the line of rupture was in the sound skin near the cicatrix; intestine at once protruded through the wound. After the lapse of three hours Mr. Pitts saw her, and found a stout woman much collapsed, with a foot and a half of small intestine, bruised, congested, dirty, and very cold, protruding through an external wound about one inch long. He cleansed the part with warm carbolic lotion, and after enlarging the skin opening returned the protruding bowel, and with it the cæcum and about five feet of small intestine that had been in the sac. He cut off redundant skin and sac, and stitched up the part, making good provision for drainage. A good recovery ensued. A second case, like the above, is also recorded by Mr. Jones ('Lancet,' April, 1880).

On peritonitis following obstruction.

Intestinal Obstruction and Peritonitis as a result of the Adhesion of a piece of Intestine to the Hernial Sac.

I published such a case in 1861, in part iii of my 'Clinical Surgery,' and Mr. Birkett, in his excellent article in 'Holmes's Surgery,' third edition, vol. ii, 1883, has given a second case with a drawing, which I also had the advantage of seeing, and he alludes to the fact that M. Littrè called the attention of the profession to the cases illustrated by the above in a paper, "Sur une nouvelle espèce de Hernie," 'Mém. de l'Acad. Royale des Sciences,' 1700, p. 300. The notes of my case are as follows:

Example.

Umbilical hernia; obstruction to the bowels from a sacculated adherent colon; death.—A woman, æt. 56, having had a hernia for many years, was suddenly seized some twenty-four hours before her admission into Guy's, under the care of Mr. Cock, with symptoms of strangulation. The taxis, under the influence of chloroform, proved successful, but collapse and death followed in twelve hours. After death, general peritonitis was found to have been present; the intestinal coils being all adherent. An umbilical omental hernia, the size of a fist, existed, the omentum forming a distinct sac. To the centre of this the anterior wall of the transverse colon was firmly adherent, forming a kind of pouch. The colon was, however, tolerably free. The intestines above this point were distended, and below it contracted and empty. The cæcum was of an enormous size, almost filling the lower part of the abdomen. It was here that the tension had been experienced; it was black, and in places the peritoneal coat was fissured, leading to the belief that but little extra distension could have been borne without a rupture taking place. The mucous membrane was also lacerated transversely, while the walls were so thin that they were nearly ruptured in handling, these conditions being such as we commonly meet with in cases of chronic intestinal obstruction.

Distended cæcum.

In this interesting case death had doubtless been caused by peritonitis, although not from the strangulation of the umbilical hernia, but from a partially ruptured and over-distended cæcum; a condition of bowel which had clearly been produced by the traction exerted upon the transverse colon, the result of the adhesion of its walls to the omental sac.

As elucidating a secondary result of hernia, this case must be regarded as most valuable; illustrating, as it does, a point not perhaps sufficiently recognised, namely, the influence of the adhesion of the bowel to a hernial sac, or to the abdominal walls upon the functions of the intestines; since, doubtless, such adhesions are suffi-

Influence of adhesion of bowel to hernial sac.

cient to account for many of the griping and painful symptoms which exist in an old and irreducible hernia, as in other cases of abdominal trouble. The case referred to must also be regarded as a good illustration of the result of a long-continued interference with the bowel's action; for the over-distension of the cæcum, with its attendant consequences, was apparently due entirely to the interference with its functions, resulting from the union of the walls of the transverse colon with the omental sac. The calibre of the colon itself was not materially diminished, but its power of acting had become paralysed; the greater the distension of the intestine above, the greater must have been the traction caused by the adhesion, and as a sequel the greater was the effect of this interference. At last complete paralysis of the part had taken place, and complete obstruction, giving rise to all the symptoms and conditions which had terminated in death.

Over-distension of bowel paralysing its action.

These cases tend to prove that the smallest traction of a portion of the calibre of the intestine in hernia, or elsewhere, although accompanied with an open passage of the bowel, is quite sufficient to interfere with the bowel's action, and even to cause complete obstruction. In a former page I have pointed out how strangulation of the bowel within the abdomen may result from the formation of bands associated with an external hernia.

Slight traction of portion of bowel may cause obstruction.

Strangulated Hernia.

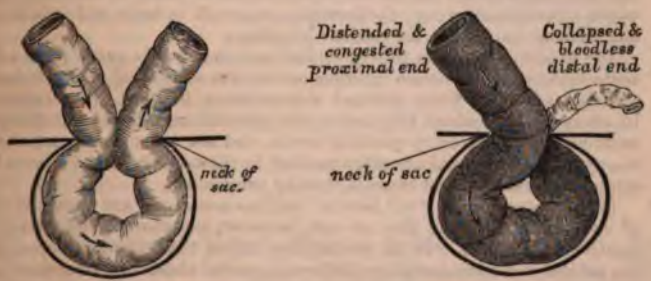
A rupture is said to be *strangulated* when in addition to its solid contents being irreducible, the venous circulation of the parts involved is more or less completely arrested.

On strangulated hernia.

This result may be brought about whenever a knuckle of intestine slips through an opening in the abdominal walls (external hernia), or is constricted from any cause within the abdominal cavity (internal hernia) by air or motion entering the upper extremity of the knuckle, and distending it so as to compress its lower end against the neck of the constricting orifice through which it may have passed (Fig. 273B).

Mechanism of strangulation.

FIG. 273A. FIG 273B.



An unstrangulated hernia. A strangulated hernia.

The greater the pressure from above, under these circumstances, the more the lower end of the bowel will be compressed, consequently the more complete will be the obstruction, and the sooner the compressed or strangulated bowel will lose its life. The part dying from static gangrene.

When occurring.

Strangulation may happen in the first descent of the rupture, "*recent hernia*," but more commonly it takes place after a hernia has existed for many years, "*old hernia*." An analysis of cases that I made in 1856 ('Guy's Reports') indicated that the average duration of an *inguinal* hernia previous to its becoming strangulated was twenty, and of a *femoral* eleven years. The same analysis likewise showed the most important practical fact that when an inguinal hernia becomes strangulated in its first descent it is generally of the "congenital," and not the "acquired" kind; also that femoral hernia was far more liable than inguinal to strangulation, and to strangulation on its first descent, and that *umbilical* hernia is less liable to strangulation than either of the two other forms, that it is little liable to strangulation in its first descent, and that when strangulated it is almost always of very long standing.

Recent hernia more serious.

A hernia strangulated on its first descent, whether of the inguinal or femoral form, requires operation more frequently than the "old" hernia, and is far more fatal, a strangulated inguinal hernia of the "congenital" kind being by far the most.

Symptoms those of obstruction.

The symptoms of strangulated hernia are those of strangulated intestine from whatever causes, and they are due rather to the obstruction of the venous circulation of the strangulated part than to the obstruction of the intestinal contents. In "*old inguinal hernia*" of many years' standing they may be *chronic;* in "*recent hernia*," and more particularly of the femoral or congenital inguinal form, they are *acute*.

General symptoms.

It thus often happens that in an acute or "recent" inguinal or femoral hernia, its descent is accompanied by severe abdominal pain in the region of the umbilicus, vomiting first of the contents of the stomach, then of those of the duodenum (biliary vomiting), and, at a later stage, of the yellow contents of the small intestine and even of fæces, and later on by more or less collapse. Constipation is also usually present, although on the first onset of the symptoms, it is not uncommon for the large intestines to empty themselves. With these general symptoms of obstruction, the local signs of hernia will be present at one or other of the sites at which a hernia may occur; the hernial tumour will be tense and painful, and without impulse on the patient coughing.

Local signs.

Symptoms of acute hernia, those of internal strangulation.

The general symptoms thus described are common to every form of acute intestinal obstruction whether outside the abdominal cavity from a hernia, or inside from internal strangulation, ileus, or other cause. In every case in which they occur, the practitioner should carefully examine the site of every possible hernia, and not trust to the patient in any way, as the local are often masked by the severity of the general symptoms, and the local cause is thereby overlooked.

Symptoms in old hernia, those of chronic obstruction.

The symptoms in an "old hernia" are less acute, and are more those of chronic obstruction; they are not, however, less characteristic when *vomiting has set in*. In all probability before this symptom appears the patient will have complained of some general abdominal uneasiness, such as flatulence, a feeling of faintness, nausea, and fulness, with local pain in the hernia; the nausea, however, will soon be followed by persistent eructations, hiccough and vomiting; in most of the cases constipation too will be present, though in some the desire to go to stool will be great and the straining severe. The local signs of strangulation or obstruction are often so slight as to be disregarded by the patient, and unless the hernia is discovered by the Surgeon,

his attention will probably not be drawn to it by the sufferer. Thus, at Christmas, 1870, I reduced a femoral hernia by the taxis, strangulated for a hundred hours in a man who was unconscious of its presence till a few hours before.

Progress of hernia when unrelieved.

If the obstruction remain unrelieved the powers of the patient will probably become prostrate, and more or less complete collapse will show itself, with a feeble pulse and cold clammy skin. The vomiting also may diminish in intensity or even cease, at times remaining only as a passive pouring out through the mouth of the intestinal contents. Pain previously severe may also suddenly disappear. The collapse, indeed, may be so great that the parts about the neck of the sac will become relaxed, and the hernia may go up either by itself, or by the gentlest pressure, and such symptoms indicate a serious collapse of the general power of the patient as well as a destruction of the parts strangulated. Under these circumstances death may be looked for, either from the shock to the nervous system, gangrene or death of the strangulated bowel, rupture of the bowel at the line of stricture, fæcal extravasation, or peritonitis.

Collapse.

Gangrene of bowel.

When gangrene of the bowel is the cause of death, the collapse may be as great as it is from shock, although of greater duration. Death, however, is slower.

Rupture of bowel.

When rupture of the bowel with fæcal extravasation is followed by collapse, it will have been preceded by symptoms of local or general peritonitis, or by a sudden severe abdominal pain; for in all cases of strangulated hernia, in which any delay in reduction has taken place, symptoms of inflammation of the protruded parts, of local peritonitis, around the neck of the sac, and subsequently of general peritonitis, will be sure to show themselves.

Strangulated omental hernia.

Strangulated omental hernia is characterised by the same symptoms as the intestinal, though less marked and acute. The pain is not so severe, nor the vomiting so constant, constipation is less complete and insuperable, while the constitutional symptoms are also milder. The local distress is likewise inconsiderable, the tumour feeling harder, more nodular, and like to an obstructed hernia, permitting manipulation more freely than when it contains intestine. As time progresses, however, symptoms of inflammation in the hernial tumour will show themselves with those of local peritonitis, and when these appear, they are as severe and destructive as they are in other forms of strangulated hernia. In exceptional cases, however, the omentum may slough.

A strangulated omental hernia requires, consequently, as active surgical treatment as any other, as it leads to the same end—a fatal peritonitis.

Pathological Changes, the result of Strangulation.

Pathological conditions of strangulated bowel.

These are the same when they take place within the abdominal cavity as in an external hernia, and under both circumstances, the first effect of the *partial* arrest of the venous circulation through the parts is congestion—this congestion being associated with its usual accompaniment, *serous effusion*. When *complete* arrest has taken place the congestion will be more thorough, the surface of the bowel appearing of a red purple or blackish hue, and the tissues themselves thickened from effusion into their meshes or blackened, wholly or in

Serous effusion.

Extravasation of blood.

spots, by extravasated blood (Fig. 274). When they have been much manipulated by the "taxis," the extravasation of blood into the tissues is often very marked, the degree of congestion depending upon the completeness of the strangulation.

Inflammation.

When the strangulation has been acute or of long standing, and an inflammatory action been added to that of congestion, the bowel will not only be swollen but soft, and the natural glistening aspect and elasticity of its coats will have become changed for a dull appearance and leathery condition. Its serous surface may, indeed, be covered with a layer or with flocculi of lymph, or the knuckle of intestine may be wholly or in part soft and gangrenous, with ash-coloured spots on its surface, and even perforations. When the bowel dies from strangulation, the gangrene will be of the static kind.

Fig. 274.



Drawing 4816. (Birkett.)
Extreme venous congestion and interstitial hæmorrhage, the effects of severe strangulation of the bowel.

Changes at neck of sac.

At the neck of the sac other changes will also be found, and these depend materially upon the character and seat of the constricting force. Thus, when the line of a strangulation is rigid and linear, as it is in direct inguinal and femoral hernia, the knuckle of strangulated bowel, either as a whole or in part, may be rapidly destroyed by gangrene. And when the pressure is more diffused and less rapid, as in large inguinal hernia, ulceration of the mucous membrane at the line of stricture, even to perforation, is more common—the grooved or sulcated condition of the serous surface in the line of stricture being found in both.

Ulceration of mucous membrane.

Peritonitis.

Within the abdomen every indication of peritonitis, from the mere

greasy condition of peritoneum to fibrinous or even suppurative effusion, may be met with. In most cases local peritonitis will be found about the seat of hernia, and in some the peritonitis will be general. The strangulated portion of bowel will almost always be found at the neck of the sac, if not adherent to it, with more or less matting together of the neighbouring coils.

That this peritonitis is to be directly attributed to the strangulation of the intestine is generally acknowledged, few cases of strangulated hernia remaining long unrelieved without local or general peritonitis making its appearance; the peritonitis commencing in the bowel above the seat of strangulation. It is also indisputable that this peritonitis is often aggravated, and at times caused by the reduction of the inflamed and injured contents of the hernial sac into the abdominal cavity; but to assert with some Surgeons that in the bulk of cases it is the return of the intestine into the abdomen that gives rise to the peritonitis, is an assumption which facts hitherto known do not bear out.

Sloughing of bowel.

When the intestine has sloughed wholly or in part, and discharged itself through the wound, an artificial anus is said to exist, and this result is far more common after femoral than inguinal hernia.

When the bowel subsequently ulcerates after its reduction, either at the line of stricture, as it may in inguinal hernia; or, at the centre of the knuckle, as is the more common in femoral hernia; extravasation of fæces may take place, half of these cases of extravasation being either general into the peritoneal cavity, and fatal; or local and at the neck of the sac.

Statistics of artificial anus.

The following facts, published by me in 'Guy's Hosp. Rep.,' 1856, on the causes of death in hernia, will tend to prove these points. Out of 17 cases of artificial anus after hernia, 13 followed femoral, 3 inguinal, and 1 umbilical. Out of 15 cases of gangrenous bowel, 11 were femoral, 4 inguinal. Hence, out of 32 cases of gangrenous bowel, 24 were femoral, 7 inguinal, and 1 umbilical, clearly proving that *gangrene of the intestine and artificial anus are more common after femoral than inguinal hernia.*

Of 15 cases of hernia in which the strangulated bowel was found perforated, 10 were femoral and 5 inguinal; in 4, all inguinal, the perforation was at the line of stricture; in 11 the perforation was in the centre of the knuckle, 10 being femoral. In 8 of these 15 cases extravasation of fæces was prevented by inflammatory exudation sealing the aperture. In 7 it existed, but in 5 only of these was it general; in the other 2 it was local. Of these 7 cases, in 2 the taxis was the direct cause, in 1 gangrene, both being cases of femoral hernia; in 4 ulceration at the line of stricture was the cause, all being inguinal.

From these facts it is evident "that ulceration in the line of stricture with fæcal extravasation is more frequent in inguinal than in femoral hernia, and that when it is found in the latter, it is generally from rupture of the bowel from forcible taxis."

Stricture of small intestine after hernia.

As a result of a strangulated hernia, I must mention a stricture of the intestine due to contraction of the bowel that had been strangulated, a unique example of which took place in my practice in 1870 in a woman, æt. 52, upon whom I had operated for strangulated femoral hernia of thirty hours' duration, without opening the sac. Convalescence followed the operation, but about the seventh week vomiting appeared, and death took place in the eleventh week from intestinal

obstruction. After death a complete stricture of a knuckle of bowel was found (Fig. 275).

Fluid in internal sac.

The fluid found in the hernial sac varies according to the condition

FIG. 275.



Stricture of intestine after strangulation.

Stricture of the small intestine after strangulated hernia.

of its contents. In the early period of strangulation, when the venous circulation through the contents of the hernia is only partially arrested, simple serum will be found. When blood stasis is more marked the serum will be blood-stained. When it is complete, and blood has been extravasated into the tissues, blood elements or blood itself will be found in the sac. When the hernial contents are inflamed flakes or flocculi of lymph will be found floating in the dark fluid. When the bowel is gangrenous the fluid in the sac will be fœtid. When perforation has taken place, fæces, and often gas, will be mixed with the fluid. When the hernial tumour is red, infiltrated, and emphysematous, the Surgeon may safely infer that sphacelus of the gut exists.

Local symptoms of gangrene.

Thus, the condition of the fluid in and the external aspect of the sac are valuable aids to diagnosis and prognosis in strangulated hernia.

Treatment of Strangulated Hernia.

Treatment of strangulated hernia.

When a hernia is strangulated nothing but its immediate reduction should be entertained, since by delay the venous circulation through the strangulated bowel *hourly* increases, and the risks of static gangrene are rapidly increased. In the Surgeon, indeed, delay is criminal. This may be done by manipulation, or by what is technically called "the taxis," and, when this fails, by "the operation" of herniotomy.

Taxis.

Chloroform.

To aid the Surgeon in the adoption of these means the use of an anæsthetic cannot be too highly praised, containing as it does within itself all the advantages of every other form of treatment without a single disadvantage. It renders the reduction of a hernia by the taxis a gentle and comparatively simple measure, and, certainly, a far more successful one than of old. It facilitates also the operation of herniotomy on the failure of the taxis. In strangulated hernia the value of an anæsthetic is so great that I would urge, where it can be rendered available, that the taxis should never be employed without it,

and that on the reduction of the hernia failing to be accomplished "the operation" ought to be performed. The warm bath, the administration of opium, the local application of ice, are poor and unreliable remedies for strangulated hernia, since they encourage delay, although in *obstructed* or *inflamed* hernia they are of use.

Effects of taxis.

The taxis is not equally successful in every form of external strangulated hernia. In *inguinal* cases two thirds, at least, are reduced by the taxis, a large proportion of these being successfully treated with the patient under the influence of an anæsthetic, when the taxis without an anæsthetic had previously failed. Strangulated old are also more successfully treated by the taxis than recent herniæ, and more particularly when the recent cases are of the congenital form.

In *femoral* hernia, on the contrary, the taxis is not half so successful as in inguinal, and it is much more fatal. It is most successful in "recent," whilst in old cases it seldom succeeds.

In *umbilical* hernia two thirds of the cases are reducible by the taxis.

The Taxis.

Mode of applying taxis.

With the patient under the influence of an anæsthetic and placed on the back, the shoulders raised and the legs partially flexed and rotated inwards—in order to relax all the parts that can possibly affect the neck of the sac—the Surgeon should steadily grasp with the fingers and thumb of one hand the neck of the sac, so as to fix it and at the same time prevent the contents of the sac on being pressed from bulging round the orifice. With the other hand he should then raise the tumour, if large, and gently compress it, so as to empty it of its serous, gaseous, fæcal, or venous contents, and thus lessen its size. Having done this, he should draw the tumour first to one side and then to the other, with the view of opening the constricted lower end of the strangulated gut, to allow the contents of the bowel to pass onwards (*vide* Fig. 273B). He should remember that this *cannot* be effected by any direct pressure upon the hernial tumour itself, but it *may be* by lateral; for if the slightest movement of the lower or constricted end of the knuckle can be made in the direction of the upper or distended one, the lower opening will probably be freed, and the reduction of the hernia effected by its *sudden rush* backwards into the abdominal cavity, when the Surgeon may be assured that all is well.

Its rush upwards.

When the tumour has diminished in size, and its diminution has *not* been accompanied by the well-known rushing sensation, a feeling of doubt should ever remain in the mind as to the result, since the want of this symptom of proper reduction should suggest the possibility of a rupture of the bowel, or of a reduction into one or other of the unnatural pouches which are now known to exist under certain circumstances at the neck of an inguinal hernia.

Gentle kneading at neck.

To facilitate reduction, a *gentle* kneading movement of the fingers at the neck of the sac may be made in inguinal hernia, as well as a steady traction downwards of the tumour, this traction rendering the neck of the sac a straighter channel for the hernial contents to pass through. With a similar object the sac itself may at times be pinched up with the fingers of one hand, and drawn downwards. Violence in manipulation is unjustifiable under all circumstances, and in

Force unjustifiable.

proportion to the period of strangulation, as indicated by the vomiting, is the danger increased. In femoral hernia also it is comparatively much more injurious than in inguinal, for not only may the bowel be ruptured by forcible taxis (an accident more common in femoral than inguinal hernia) ('Guy's Rep.,' 1856), but it may be so bruised as to be irreparably injured. A preparation and drawing (Fig. 274) in Guy's Museum show such extravasation of blood into the strangulated bowel of a femoral hernia as to cause its complete death, this being clearly due to forcible taxis.

Where taxis is inadmissible or dangerous.

Where evidence exists that gangrene of the contents of the sac has taken place, or where, indeed, there is a suspicion of such a result, the taxis must not be used. When the hernia is inflamed, or has been much manipulated, the same advice should be followed. In recent or old femoral hernia, where fæcal vomiting has existed for some hours, the taxis is a dangerous practice, and in all old cases, it is so unsuccessful that reduction by herniotomy is a more certain and safe method. If there be hiccough, the taxis is inadmissible. The taxis may succeed without an anæsthetic, but, with it, a hernia that is capable of being reduced by the taxis, as a rule, returns on the gentlest manipulation, and when such a result does not follow, force will be not only unsuccessful, but injurious.

Treatment after reduction.

When the taxis succeeds, vomiting usually disappears, although it may be kept up to a slight extent as an effect of the anæsthetic. The abdominal dragging pain will, however, be at once relieved. After the reduction of the hernia, a sponge pad should be carefully adjusted over the neck of the sac to guard against its re-descent, and, when the patient has a cough, the necessity of doing so is increased, as I have known the hernia re-descend and a renewal of all the symptoms take place from a want of attention to this point; indeed, it is wise to adopt a pad till a truss has been obtained. The patient, under all circumstances, should be kept at rest for a few days after the reduction of a strangulated hernia. The diet, too, should be nutritious, but not solid, *till the bowels have acted spontaneously*, and no aperient under any but exceptional circumstances should be administered, for the bowels will, to a certainty, act as soon as the effects of their strangulation have passed away, and they have recovered their natural tone. If, however, abdominal symptoms appear which can be attributed to a want of the natural action of the bowel, an enema may be given, and repeated with advantage when required. Stimulants should be used with caution. When the bowels have acted naturally, the patient may be pronounced convalescent, and the ordinary diet, &c., allowed.

Avoid aperients.

Opium.

Where an anæsthetic is not at hand, or cannot readily be obtained, a good dose of opium, such as a grain and a half of the solid or thirty drops of the tincture may be given to an adult and repeated, for when a patient with an old obstructed hernia is brought fully under the influence of this drug, reduction may often be obtained by manipulation. In the very earliest hours of strangulation, before vomiting has become severe or passed beyond stomach vomiting, this practice is also at times successful. It may be tried, moreover, when the Surgeon cannot obtain the patient's consent to perform herniotomy, and reduction has not been effected by the taxis under an anæsthetic, or when time has necessarily to be lost in making arrangements for operative relief.

Hot bath.

Under the same circumstances, a hot bath (98° F.) may be used. The

local application of ice should be employed in cases of *old* hernia where the symptoms are more those of obstruction, and delay is a necessity or expedient. In omental hernia, also, it is particularly valuable, and should be applied over the whole tumour in a loose bag, or as a metallic coil. A purgative is never admissible with a strangulated hernia. Ice.

The taxis with inversion of the body, the legs flexed, pelvis raised, and shoulders depressed, has been successful in causing the reduction of a hernia, the intestines, by their weight, drawing upon the incarcerated or strangulated bowel, and helping reduction. On a bed, it may be done by pillows placed below the pelvis; but if one of Alderman's chairs or a lithotomy couch is at hand, it may be used. Some Surgeons, with the patient in the recumbent position, and a folded sheet placed round the abdomen over the umbilicus, have forcibly drawn the contents of the abdomen upwards. Both these methods are founded on the principle of withdrawing by position and force the contents of the sac into the abdominal cavity. They are *possibly* justifiable when herniotomy is not sanctioned nor an anæsthetic employed, and delay is dangerous. I cannot recommend them. Taxis with posture as an aid.

The taxis should never be employed for any lengthened period. With the patient under an anæsthetic, femoral hernia of average size (that of a walnut) should never be manipulated for more than two minutes; half that time, or less, is usually sufficient to effect reduction where it is to be secured, while any more prolonged effort will be injurious. The taxis should never be forcible. In large femoral, inguinal, or umbilical herniæ, five minutes may possibly be allowed; but the quarter and half hour's manipulation, so frequently talked about, is dangerous in the extreme. It is from this fact, coupled with another, viz. that without an anæsthetic twice the force is needed, that the use of such is to be recommended. Prolonged taxis to be avoided.

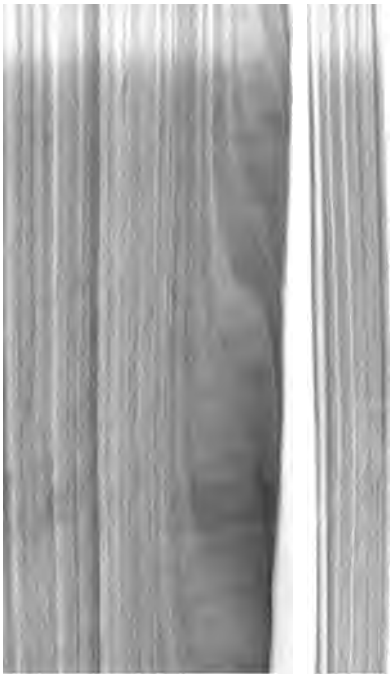
The reduction of a hernia by *gentle* taxis with a patient under an anæsthetic is a simple, rapid, and successful operation. The reduction of a hernia by *forcible* or prolonged taxis without an anæsthetic is a dangerous and far less successful proceeding. In femoral hernia, indeed, herniotomy had far better be employed. Under an anæsthetic the taxis is almost always successful in inguinal hernia, not of the congenital form.

When the taxis has failed, nothing but an immediate operation is justifiable. The operation is not of itself dangerous, although the condition that demands it is so exceedingly. It is not, and should not be regarded as a last resource; for in many cases it should be the first. When a patient is hanging, the first thing any one does is to cut the rope that is causing strangulation; and no other means are admissible. When a piece of bowel is strangulated, the strangulating medium requires division to give it freedom; the doing of it adding nothing to the danger of the case. The danger lies in the strangulation, which increases every minute. Operative measures.

Herniotomy or Kelotomy

Herniotomy.

remains now to be described, and let it be repeated, *that it is to be performed directly the reduction of a strangulated hernia by the taxis has failed, and, if an anæsthetic is used, while the patient remains*



performing the operation.

influence of
raised, the k
hernia shave
made over th
of the ingui
femoral ove
vertical dir
being prefe



Key's director

arefully passed beneath it, Aston Key's flat director, shown in Fig. 76A, being by far the best.

With a straight or curved hernia knife, such as that figured Fig. 277), or with a herniotome (Fig. 277B), the stricture should hen be divided, the incision *upwards* being the safest. This vision must not be too free—a quarter of an inch being gene- lly ample in a small hernia. It should, under all circumstances, be ily enough to allow of the return of the hernia without force. It better to have to extend it than to make it too large at first. The ricture having been divided outside the sac, reduction by the gentlest anipulation can then be attempted, and, when the contents of e sac go back with a rush, all the Surgeon needs has been effected. hen no indications of reduction show themselves, or a portion of the ntents of the sac has disappeared, but not with the characteristic rk, or some piece has been left behind, the sac must be opened. o open the sac, care is needed, the danger of carelessness consisting wounding the bowel. To avoid injury to the contents, the sac may nipped between the thumb and finger, or seized with forceps, and, ing slightly raised, opened with a scalpel applied laterally. Through is opening a director should be passed, its point being kept close to the ner surface of the sac towards its neck, and upon it the sac should be vided with a bistoury. The escape of fluid usually indicates the open- g of the sac, and the character of the fluid, the condition of its contents. at fluid does not always run away when the sac is opened, and at

Division of stricture outside sac.

Sac to be opened on failure of reduction.

FIG. 277.



Hernia knife.



Herniotome director—A, Blade withdrawn. B, Blade exposed.

er times the escape of fluid from a cyst on the hernial tumour may lead. The sac having been opened, its contents should be ex- ined, and in doing this the utmost gentleness must be employed. hen a *knuckle of intestine* is present, and is neither gangrenous nor forated, the abdominal cavity is the best place. It may be black m congestion and spotted from ecchymosis; it may be granular from ph, or even covered with false membrane; but, as long as it pos- ses its living resiliency, is not fœtid, flaccid, like wet wash-leather, tured, or perforated, it should be returned.

Examination of contents.

When a *large quantity of injured intestine* is found in the sac it had ter be left, the Surgeon simply relieving the constriction by the ision of the stricture. To do this, a director should be employed, its point kept close to the inner surface of the sac, and away from bowel; it should not be introduced further into the abdominal ity than is required to ensure the safe division of the stricture;

Care in dividing the neck.

when the knife is passed along the groove of the director, the finger of the operator should carefully press the strangulated bowel away to protect it from injury. The finger, however, is the best director, and should be introduced to the neck of the sac, with the knife upon it, having its side pressed into the pulp of the soft parts. Both having thus reached the neck, the knife may be carefully turned upwards and the tissues divided, the point of the finger measuring the extent of the incision.

Finger best director.

When a herniotome such as that figured (Fig. 277B), is used, no director need be employed.

When the *intestines are adherent* to the sac or to one another by filamentous or soft adhesions, these may be divided; such are, however, only met with in recent hernia. The fibrous adhesions of old hernia had better be left alone, and the hernia considered as irreducible, the Surgeon being satisfied, under these circumstances, with dividing the stricture, and thereby relieving the strangulation, but not attempting the reduction of the hernia. If a fresh piece of bowel comes down, it should be reduced, but the old hernia ought to be left.

When intestine adherent.

The strangulated intestine, under all circumstances, should be handled with extreme delicacy. *Any drawing down of the bowel* to examine its condition should be avoided, since such an act can do no good, but often does much harm, in tearing away adhesions that would have sealed an ulcerated orifice, prevented extravasation, and assisted repair.

Care in handling bowel.

Any introduction of the finger into the abdominal cavity, save under exceptional conditions, is also to be condemned. With the careful return of the bowel within the neck of the sac, surgical interference ought to cease. The Surgeon may satisfy himself that such an end has been obtained without probing the abdominal cavity with his finger, and thus risking life by tearing away adhesions, and undoing in a moment what nature by her own processes had probably been attempting from the first period of strangulation, namely, to shut out from the general abdominal cavity what might prove injurious and dangerous to life.

Avoid useless exploration.

When the *bowel is dead*, as indicated by its flaccidity and ashy colour, all thought of its reduction must be abandoned. The soft parts covering in the sac, with the sac itself, should be freely laid open, so as to expose the whole sloughing mass, *and the intestine left to nature*, to pass into what is called an "artificial anus." The neck of the sac may be carefully divided, not, however, with the view of relieving the strangulation, for the gut having become gangrenous, is no longer strangulated, but with a view of allowing the intestinal contents to escape when an external opening takes place, and should life be spared, and likewise for the subsequent retraction of the bowel towards the abdominal cavity, to effect a natural cure.

When bowel is dead.

No free incision into the gangrenous bowel, no stitching of the intestine to the margin of the wound, is required, as fæces will soon find their way through the opening that has been made by the artificial anus, and the Surgeon may be certain that within the abdomen sufficient repair has gone on to fix the intestine that had been strangulated to the neck of the sac, and thus prevent its immediate retraction; for it must be remembered, that as time goes on, this retracting process is precisely that which nature adopts to procure a spontaneous cure of an artificial anus.

Free incision.

Within recent times a gangrenous knuckle of bowel has been *resected*, *vide* 'Revue de Chirurgie,' May 10th, 1883, and with success. When

Resection.

operation is performed, the bowel above and below the constricted ion will have to be drawn down, resected, and stitched together as trated in Fig 254A, or the two ends of the resected bowel may be ined at the neck of the sac by sutures or forceps.

When b perforat ulcerate

hen the *bowel is perforated by ulceration or ruptured*, and the ing is not large, the neck of the sac must be incised as in an nary case, and the intestine that appears reparable replaced, the orated or ruptured portion being left at the mouth of the sac. en the rupture or perforation is small, there is no objection to the geon suturing the wound, and replacing the gut within the orifice he sac, for plastic lymph will probably be poured out within a few rs, and the parts become sealed from the abdominal cavity.

When bow is in doubt condition.

hen *the bowel is in a doubtful condition*, and the Surgeon is not ain whether he can say it is irreparably dead, or going to die, the minal cavity is still its best place, when it can be returned. Aston advocated this plan many years ago, and modern experience has disproved its value. "The danger of abdominal extravasation will be increased by replacing the injured bowel within the neck of the ; for, should sloughing of its coats ensue, the slough may be walled y addition of the surrounding peritoneum, and fæcal extravasation revented." (Key, 'Guy's Rep.,' 1842.)

Causes of death in hernia.

n an inquiry in 1856 into the causes of death in hernia, founded on nalysis of 156 fatal cases, the same conclusion was arrived at. The ght of evidence led me then to express the opinion that there is one condition of intestine in which its reduction within the neck he sac is not advantageous, and that is, when it is decidedly ruptured angrene or ulceration, my own materials tending to support the ion of Mr. Aston Key, as stated to the writer, in 1849, "that in all itions of the intestines, the abdomen was their right place."

. Hutchinson, who believes peritonitis to be the direct result of eduction of an injured bowel into the abdominal cavity, advises in ses that the damaged gut, if found in a bad condition, should be the sac; while Mons. Girard goes further, advising the contents hernia, under all circumstances, to be left—the Surgeon con- himself by freely dividing the stricture. I cannot concur in actice, nor with the principle on which it is based.

n the contents cannot be returned on account of adhesions, the the sac should be incised and the case left to nature. In large al herniæ also, this practice is valuable.

When omentum in sac.

omentum is found in the sac with intestine, and has only descended, it may be returned. When it has been down for e, is irreducible, and is only a small piece, it should be left he omentum, doubtless, often acting as a plug to the orifice of When it is diseased or in large quantities, it should be liga- two or more portions and cut off—the ligatures being applied the neck of the sac as possible, care being observed not to e parts at the neck.

Risks in removing omentum.

to cut off the omentum and to tie or twist the vessels is omentum always being highly vascular, and small vessels o bleed much; indeed, cases are on record in which a fatal e supervened after this practice. When diseased omentum e sac, prolonged suppuration often follows. Whenever in- omentum are found together in a hernia, much care is

required. The intestine is generally to be sought for *behind* the omentum, but is often wrapped up in it, and, in not a few cases, covered by an omental sac. Under all these circumstances, the intestine should be exposed and carefully reduced, care being taken that no adhesions at the neck of the sac, or no bands, bind the bowel down to the omentum, thereby keeping up the strangulation. An omental sac is on no account to be returned into the abdomen unopened. Omental sacs are generally found in femoral hernia. An interesting paper by Prescott Hewett ('Med.-Chir. Trans.,' 1844) may be referred to on this subject.

Excision of sac after operation.

It has been my practice, and that of most of the Surgeons at Guy's Hospital during the last three or four years, to dissect out the sac after the operation, stitch up its neck, and excise its fundus; this measure apparently but little, if at all, magnifying the operation, and being successful as a radical cure.

Treatment after herniotomy.

AFTER-TREATMENT.—When a hernia has been returned into the abdominal cavity, the more the case is left to nature the better. As a matter of precaution after the operation, as after its reduction by the taxis, when the wound has been brought together with strapping or suture, a pad may be adjusted over the part with a spica bandage (Fig. 278). A sponge is the best form of pad.

A suppository of half a grain of morphia or more should be at once introduced into the rectum, and repeated in an hour should pain render it necessary; a little ice, too, may be allowed for the patient to suck, when thirst is great, but the less that is taken by the mouth the better. When the powers are very feeble, brandy, soda-water, and ice may be given in small quantities.

FIG. 278.



Spica bandage.

If no anæsthetic sickness complicate the case after the first twelve hours, beef tea, arrowroot, or milk, may be given, a pint or a pint and a half in the twenty-four hours being ample. Stimulants should be allowed as the powers of the patient indicate, but always with caution.

Opium.

On the second day the wound should be dressed, some simple dressing being all that is usually required, the lower end of the wound being left open for the escape of fluid. Should pain continue and symptoms of peritonitis appear, opium should be given, or morphia suppositories twice a day or more frequently; indeed, the patient should be kept under the gentle influence of opium till the symptoms are relieved; hot fomentations should also be applied to the abdomen. Purgatives

Avoid purgatives.

ought never to be given if the bowel has been bruised or otherwise injured by strangulation, for as soon as it has recovered its tone its natural action will return, and any goading of it to action by medicine must do harm. "A bruised bowel," says Aston Key ('Guy's Rep.,' 1842), "is placed by nature in a state of rest; the exhaustion of the nervous energy of the part diminishes in the muscular tissue the

ion to contract. *Such inactivity of the bowel should be en-d and not thwarted* by irritating purgatives. The Surgeon's to procure stools should yield to the evident necessity for time llowed for the restoration of the natural powers of the injured

, five, ten, or even twenty days may be allowed to pass without ion of the bowels, without anxiety or without purgatives, so no other indications of mischief show themselves; but during ıe only liquid food is to be given, with stimulants as may be l. When some local distress is present, which the Surgeon can ttribute to the constipation, an enema of gruel and olive oil administered, which may be repeated if necessary, such a simple al stimulant being usually sufficient to induce the bowel to act t have recovered its tone. When the bowels have acted natu- nvalescence may be declared and the usual diet allowed. When enema to be used.

riolent action of the bowels soon after the operation must be d with anxiety, and in the aged it is too often followed by a llapse. When too frequent it must be checked by opium. The on no account should be allowed to get up and walk until he has ted with a good truss.

casionally happens that, after the reduction of a hernia by n, the symptoms of strangulation persist, and the Surgeon is t as to their cause. Moreover, the bowel may not have gone ıe time of the operation with the usual rush, or the Surgeon ve a doubt in his mind as to its right reduction. Under these tances, the wound may at times require reopening, and the the neck of the sac re-explored, since the case may be one of displaced herniæ" to which attention is now to be drawn. Persistency of symptoms.

rule, however, the persistency of the symptoms is due to the ion caused by the injured bowel, or to the anæsthetic.

Multiple Herniæ.

ı *two or more herniæ* exist with symptoms of strangulation, that on careful examination appears to be the most tender ought be explored, and should this operation not give relief, the should be treated in a like manner; indeed, if no relief be y the second operation and a third hernia exist, it should also be l, for it cannot be too often repeated, that the operation is not danger when compared with the necessity of the case that s it. Dupuytren in his 'Leçons Orales' has recorded such a ın the third part of my 'Clinical Surgery,' p. 204, I have like- corded another in which Mr. Cock was the operator. The was a man æt. 70; the left side was first explored, but as the ns continued the right was operated upon twelve hours later. rniæ were old inguinal, in both the sac was opened, and re- ook place. In the case of a Jewess, æt. 30, I was called upon with an umbilical and double femoral herniæ, I operated on the emoral for strangulation, and a year later upon the umbilical, ccess. Multiple herniæ.

Displaced Herniæ.

ıses demand closer attention than these. When understood and ıted they may be successfully treated, when misunderstood Displaced herniæ.

they are sure to be overlooked. Hence it may be accepted as a fact, that a strangulated hernia with its sac may be bodily reduced within the abdominal ring and behind the abdominal parietes, the intestine being still held by the neck of the sac (Fig. 269). This form was first described by the French writers as "reduction en bloc," or "en masse," and by Mr. Luke in this country ('Med.-Chir. Trans.,' 1843). The majority of cases reputed to be of this nature are, however, probably caused by other lesions of the sac, and the credit of having made this out is due to Mr. Birkett, in an able paper read before the Royal Med. and Chir. Society in 1859. He describes three forms, though his observations apply only to inguinal hernia.

Causes leading to displaced hernia.

Varieties of displaced hernia.

There are four varieties of displaced hernia, and in the inguinal they are mostly found as complications of the congenital form.

First form.

First Form. In this the strangulated hernia with its sac may be bodily reduced within the abdominal ring and behind the abdominal parietes; it is to a femoral hernia that this accident is most prone to occur, but it may do so to an inguinal. It is the true "reduction en bloc," or "en masse," of the French writers and of Luke. Such cases, are, however, rare. In November, 1871, I had this fact demonstrated to me in a case I was called to see by Mr. Berry of Pentonville. It was in a lady, æt. 64, who was said to have been ruptured for years, and had worn a truss. When I saw her she had been vomiting for a week, and a tense femoral hernia existed. Under chloroform, I cut down upon the sac and divided the neck of the crural ring, and on attempting reduction of the sac's contents by gentle manipulation, to my surprise the sac with its contents suddenly disappeared into the abdomen. By a little abdominal pressure it was made to reappear, and it did so in the same sudden way. A second attempt at the taxis was followed by the same result, and renewed pressure upon the abdomen with a like reappearance. For the sake of fully satisfying myself and my medical friends of the nature of the case, I reduced the hernia *en masse* a third time, and then found some little difficulty in securing its reappearance. When I did so, I took hold of the sac with my forceps, carefully opened it, and exposed the bowel without letting the sac go; I then divided its neck by a herniotome and reduced the bowel, keeping the sac well down. On the second day the bowels acted, but the patient subsequently died of a low form of peritonitis. In this case the whole process of reduction *en masse* was demonstrated most clearly, and it compelled me to ask the question whether the same result might not have taken place had I attempted its reduction by forcible taxis without operation, since the facility with which the sac passed up within the crural ring was something startling.

Reduction *en masse*.

Example of.

In Prep. 2503[30], Guy's Hosp. Museum, this accident may be seen. It was taken from a woman æt. 58; and my friend Mr. Henry Morris showed a specimen illustrating this fact at the Pathological Society. *Vide* 'Trans.' for 1871.

Second form.

Second or Charles Bell's Form. In the *second* form the neck of the sac becomes detached by force from the internal abdominal ring, and pushed upwards beneath the abdominal walls, the intestine within the sac being strangulated by the orifice of the sac. This variety is illustrated by diagram 266, and still better in Figs. 279 and 279A, which I have copied from page 486 of the first vol. of the 'Medical Gazette,' published in 1828. The case formed the subject of a lecture by Sir Charles, then Mr. Bell.

Displaced neck of sac.

Sir C. Bell's case.

It occurred in a man æt. 47, who had been the subject of a right scrotal hernia for twenty years. The hernia had come down and become strangulated three days before he was seen, but had been reduced, or rather *made to disappear*. The symptoms, however, continued, and death followed. During the last twenty-four hours of the patient's life the hernia came down repeatedly during the day, and was each time reduced with great facility.

Bell's description.

After death the hernia was found to be in the scrotum, strangulated and mortified (Fig. 279). On applying pressure to it "the intestine could very easily and effectually be pushed through the external abdominal ring, so as to be hid from sight. On looking to the inside, however, it was seen that the portion of gut had carried the neck of the sac before it into the abdominal cavity, B, Fig. 279; and the duplicature of peritoneum which hung upon the inside of the neck of the sac being unfolded, had formed a new sac for the intestine in the inside of the abdominal muscles. Thus the fold of intestine was pushed through the external ring, through the spermatic canal, and through that part which is described to be an internal ring (but of which no trace could be seen), and was reduced within the abdominal muscles but not within the abdominal cavity," the neck of the sac still grasping the included portion of gut (B. Fig. 279A). The hernia was also clearly of the congenital form, although it had not descended as far as the testicle.

The two drawings (Figs. 279 and 279A) and descriptions are given as originally described by Sir C. Bell.

Fig. 279.



Fig. 279A.



Drawing illustrating the second varieties of displaced hernia.

Fig. 279.

A. A portion of the abdominal muscles, with the peritoneal lining.
B. The strangulated fold of intestine.
E. The testicle. The dark lines at the neck of the sac represent the duplicature of the peritoneum, which being unfolded formed a sac for containing the intestine when reduced.

Fig. 279A.

A. Peritoneum lining the abdominal parietes.
B. The tumour formed when the strangulated intestine was pushed through the spermatic canal into the sac formed by peritoneum in the inside.
C. The superior portion of intestine.
D. The inferior.
E. The scrotal hernial sac.
F. The testicle, with the vaginal coat opened.

This case I have described somewhat fully, as I believe it to be the earliest on record in which this accident has been clearly made out.

Third Form. In this (Figs. 267 and 280), "as the effect of forcible and

Interstitial with ruptured sac.

long sustained compression of the hernial tumour, the delicate serous membrane of the sac is rent, burst, or torn, and the hernia makes its escape through the aperture into the sub-serous connective tissue; its course outside the peritoneal sac is advanced by continued pressure; and detaching the connections of the neighbouring peritoneum, it forms for itself a pouch between that serous membrane and the internal abdominal fascia."—BIRKETT. The posterior part of the neck of an inguinal hernial sac is the usual seat of the rupture, and the position of the artificial sac is downwards and outwards. The "congenital" form of hernial sac is also the more liable to the accident (*vide* fig. 280).

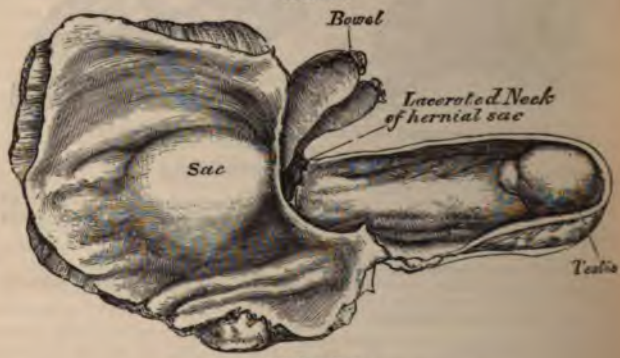
Indications of a hernia having been displaced.

The indications of the accident having taken place are as follows: I give them in Birkett's words—"The tumour becomes flaccid, and, therefore, smaller; the bulk of the tumour slowly diminishes as the pressure is continued, until at last very little, if anything, can be felt, but the *Surgeon has failed to experience that sudden jerk so characteristic of the escape of the hernia* from the gripe of the mouth of the sac as it enters the abdominal cavity. After the effects of the chloroform have passed away *all the symptoms of strangulated bowel recur*, and, perhaps, with increased force. Even the tumour itself may reappear and recede on the application of slight pressure."

Mode of proceeding in such cases.

When this condition is found there is but one form of practice to follow, and that is the exploration of the sac. At its neck two orifices will be found, one dipping down into the artificial sac, and the second into the abdominal cavity; from the latter the bowel will be seen to pass through the former into the artificial sac. The Surgeon must then draw out the bowel from the sac through its false orifice, and having freely divided the true neck or abdominal orifice of the sac, replace the intestine, and "the exercise of great care and caution is needed to prevent the entrance of the hernia once more into the abnormal space outside the peritoneal cavity."—BIRKETT.

FIG. 280.



Third variety.
Interstitial hernia with ruptured neck of hernial sac.

Fourth form.

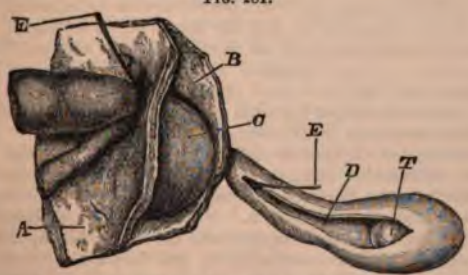
Fourth Form.—In this an intermuscular, interstitial, or *intra-parietal* sac has also been described, being a kind of diverticulum from the ingui-

nal sac, and is almost always found, according to Birkett, associated with the congenital form of hernia. This sac may be found in the anterior abdominal walls, in an upward, outward, or inward direction, mostly behind the abdominal muscles in front of the abdominal fascia, though in some instances in front of the external oblique muscle beneath the skin. Birkett refers to a case recorded by Scarpa, and to a second by Dr. Fano. Interstitial with herniated neck of sac.

I saw an example of this in 1883 in a patient of Dr. Kershaw's, of Surbiton. The patient was over sixty, and had been ruptured for years. A day or so before I saw him, in attempting reduction, the hernia partially left the scrotum, and a swelling appeared above the groin, and steadily increased, till it reached nearly to the umbilicus. The swelling was, when I saw it, nearly the size of a cocoa-nut, soft and resonant. It was clearly bowel, and not strangulated. Ice was applied, and in the course of time it returned into the scrotal sac, and gave rise to no inconvenience. Author's case.

In some cases the sac extends to the iliac fossa, and rests upon the iliacus muscle, between the internal abdominal fascia and peritoneum; or, directing itself inwards, it passes behind the horizontal ramus of the pubes, and reaches the side and front of the urinary bladder (Birkett). Diagram 268 illustrates this form of hernia, but Fig. 281 does so much more clearly. It was taken from a preparation now in Guy's Museum, which was removed from a man, æt. 36, upon whom I operated on September 23rd, 1869, for strangulated hernia. The man had been ruptured for fifteen years, and had worn a truss. The hernia had descended two days before his admission into Guy's, Case.

FIG. 281.



Drawing illustrating the fourth variety or intra-parietal form of displaced hernia.
A. Peritoneum lining the abdominal muscles (B).
C. Intra-parietal sac with strangulated bowel.
D. Scrotal hernial sac leading down to testicle (T).
E. Director passed from the congenital scrotal sac through the internal ring.
In the drawing the strangulated bowel has been introduced to make the description clearer.

but the man had pushed it up by manipulation after a little trouble, though it did not go up as usual with a rush. After its reduction vomiting appeared and local pain, and in this condition he was admitted into the hospital.

When I saw him all the symptoms of strangulation were present. No hernia was down, but there was some fulness at the internal

ring, and above this, towards the crest of the ilium, a tense globular swelling could be felt. This swelling I explored, and having laid open the inguinal canal I exposed the empty hernial sac (D, Fig. 281), with the testicle, showing that the hernia was of the congenital form. I then passed my finger into the internal ring, and came against a knuckle of tense distended intestine. I enlarged the opening, and this intestine at once protruded, which was of a dark colour, but still glistening. In following this up my finger passed downwards and outwards into a distinct cavity, which was not the abdominal cavity (C, Fig 281), filled with bowel. It was a distinct sac, with a smooth surface, and about the size of an egg. At its upper surface it communicated with the hernial sac, and above this with the abdominal cavity. I then increased the orifice leading into the abdominal cavity, drew out the strangulated bowel from the intra-parietal sac (C, Fig. 281), and returned it into the abdomen. The sac was clearly placed below the internal ring and between the abdominal muscles and peritoneum. The man died from peritonitis on the fourth day, his death allowing me to take the very excellent preparation from which Fig. 281 has been taken. The case was clearly one belonging to Mr. Birkett's third or my fourth form, an intra-parietal sac (Fig. 281, C) existing below the internal ring.

The disappearance of the tumour without the characteristic jerk and the persistence of the symptoms indicate all these forms. The treatment in all is the same as that described in the *third* variety.

Prognosis of strangulated hernia.

Prognosis.—As the danger of a strangulated hernia depends upon the amount of damage the intestine has sustained by the strangulation, so the amount of damage the bowel has received is to be measured by the intensity of the strangulation and the length of its duration. A tight, unyielding strangulation, such as usually exists in a recent femoral, or in a congenital or direct inguinal hernia, does more harm in a short period than a less tight and more yielding constricting force, such as is met with in an old oblique inguinal hernia, in a longer period; violent taxis adding materially to the danger of the case.

The existence of peritonitis before the reduction of the hernia is always an unfavorable sign, as it is not likely to be lessened by the introduction into the peritoneal cavity of a portion of bowel already inflamed and altered in character. A hernia in an otherwise healthy subject, that has not been strangulated for many hours, that has not been injured by violent manipulation, and has been reduced by the "minor" operation, will probably do well, whereas one that has been strangulated for days, or been subjected to violent taxis, will probably do badly.

When kidney diseases exist.

Where disease of the kidneys or of other viscera exists, and, in old people, the prognosis is always unfavorable.

A case in which the intestine has been freely exposed is more unfavorable than one in which no exposure has taken place, and any excessive manipulation of the hernial contents always adds to the danger.

The reduction of a severely damaged intestine is more liable to be followed by a bad result than where little injury exists, but a bowel only slightly injured in an aged or unhealthy subject is always likely to do badly.

A hernia strangulated in its first descent requiring operation is always far more fatal than an "old case."

Early reduction important.

In private practice, where herniæ, as a rule, are discovered and treated early, good success follows herniotomy, but in hospital practice, where neglect and delay combined have had their influence, treatment is very unsuccessful, nearly one half of the cases dying. At Guy's Hospital the average period of strangulation for femoral hernia is seventy-six hours; of inguinal, fifty; and half the cases that die after the operation do so within forty-eight hours, the injury to the bowel being so great, and the power of the patient so reduced, that any reaction after the reduction of the hernia is rendered impossible. Under these circumstances, the worst that can be said for the operation is, that it fails to cure.

Inguinal Hernia.

On inguinal hernia.

Inguinal hernia, or that form which protrudes through the internal or external abdominal rings, includes two thirds of all cases of hernia, and about half of all cases of strangulated hernia. Two out of three cases of strangulated inguinal hernia are reducible by the taxis, the third requiring operation. In hospital practice, half of those operated upon die; operations in recent cases being most fatal.

Oblique and direct.

An inguinal hernia is called "*oblique*" when it passes through the internal ring and along the inguinal canal downwards towards the scrotum; "*direct*," when it does not pass through the internal ring, but through the external in a direct way.

The oblique, from being anatomically placed external to the deep epigastric artery, is called "*external oblique*," while the direct, from being internal to the same vessel, is known as the "*internal direct*."

When the oblique has not passed the external ring, it is known as a "*bubonocele*"; when the oblique or direct has passed into the scrotum it is called a "*scrotal hernia*" or "*oscheocele*."

In the *oblique inguinal*, the sac of the hernia may be the natural "vaginal process of peritoneum" that was formed on the descent of the testicle in fœtal life, and has not closed, *i.e.* "*a congenital sac*" (Figs. 261, 262, 263); or an "*acquired sac*" formed by the gradual pouching of the parietal peritoneum through the ring (Fig. 265).

In the *direct inguinal*, the sac is always of the acquired form.

Anatomy of vaginal tubular process of peritoneum.

This "vaginal tubular process of peritoneum" which communicates above at the internal abdominal ring with the peritoneal cavity, and below is in close contact with and adherent to the testicle, lies in front of the spermatic cord, and before birth, or soon after, "it contracts near the head of the epididymis, its surfaces adhere firmly at that spot, and thus two cavities are formed." The inferior one forms the permanent covering to the testis, and is known as the tunica vaginalis propria testis. The superior canal, when no arrest of development takes place, subsequently contracts till the canal ceases to exist.

Varieties in the closure of the tubular process.

When an arrest of development occurs, and the abdominal orifice of the tubular process remains patent, a piece of intestine may at any time descend. *When the whole length* of the canal is open, the hernia will pass down *at once* into the scrotum to the testicle, masking its presence, and in this way the "*congenital hernia*" of Haller, the "*hernia of infancy*" of Malgaigne, or the "*hernia into the vaginal process of peritoneum*" of Birkett, is formed (Fig. 261).

When the closure of the canal takes place higher up (and such an event is possible at any point from the testicle upwards) the descent of the hernia will be limited, though its nature is the same, the only difference being, that in this condition the testicle will be found below the hernial sac at a variable distance, and separated from it. To this form of rupture, Birkett has given the name of "*hernia into the funicular portion of the vaginal process of the peritoneum*" (Fig. 262, or Fig. 279A).

Congenital form of hernia in adult life.

It should also be mentioned, that it is not uncommon for this tubular vaginal process to close at its abdominal orifice at the internal ring, and yet remain more or less open as a cavity below; and, under these circumstances, any *sudden rupture or giving way* of the closing medium will be followed by the rapid formation of a hernia, the hernia being scrotal wholly or in part, lying upon or separated from the testicle, according to the absence or position of any point of closure. This form of hernia differs only in the sudden giving way of the abdominal orifice of the vaginal process from those last described, and is very common in young adults.

Congenital form of hernia.

To all those forms of hernia in which the sac is composed of the natural tubular vaginal process of peritoneum, the term "*congenital form*" of hernia would probably be the best, as indicating their nature, distinguishing them from the other form rightly called the "*acquired*."

This congenital form of hernia is also frequently associated with some malposition of the testicle, such as its non-descent or partial descent.

Encysted hernia of tunica vaginalis.

The "*infantile hernia*" of Hey, or the "*encysted hernia of the tunica vaginalis*" of Sir A. Cooper, is an acquired hernia, the hernia *gradually pushing* the tissues closing the orifice of the vaginal process of peritoneum downwards into the open canal, the protruded parts together with the sac being contained in the tunica vaginalis testis, and the true sac being within that which might have been the congenital (Fig. 264).

Hour-glass contraction of scrotal hernia.

The hour-glass contraction of a scrotal hernia is always found in the "congenital form," and is due, as described by Birkett, to the imperfect closure of the vaginal sheath above the testicles, where union of its walls normally takes place. Prep. 2368 in Guy's Museum will explain these cases, also Fig. 263.

The acquired form of inguinal hernia a slow act.

The acquired form of inguinal hernia, oblique and direct, is *always slow* in its formation, the pushing downward of the parietal layer of peritoneum by the protruding viscera being a gradual process, thus forming a marked contrast with the congenital form. In the oblique, it begins as a slight yielding at the internal ring, and, in the direct, at the external, this yielding passing into a "pouching," till at last the pouch may reach and even fill the scrotum. In the early stage, this yielding may be scarcely perceptible, but to the patient it will give rise to a feeling of weakness and often of pain on any abdominal muscular exertion being made. When a "pouching," or according to Malgaigne, a "pointing," of the hernia has commenced, any act of coughing or straining will make it visible.

Bubonocele.

When the *oblique* hernia has filled the inguinal canal, it will appear as an ovoid swelling *above* Poupart's ligament (*vide* Fig. 270), beneath the tendon of the external oblique muscle. When it has passed through the external ring, the long axis of the tumour, and more particularly its neck, will still be in the inguinal canal above and parallel with

Poupart's ligament; but, having escaped from beneath the external oblique muscle, it will appear as a pyriform scrotal tumour of variable size. The testicle will always be found below and distinct from the sac, the cord being behind the tumour.

Direct inguinal.

In the *direct* inguinal form in which the pouching of the hernial sac is directly behind the external ring (Fig. 271), there will be no inguinal neck such as exists in the oblique, the hernia passing directly through the external ring down into the scrotum. This form of hernia has thus a more globular shape than the oblique.

Diagnosis between oblique and direct hernia.

When the *oblique* inguinal is reduced, the Surgeon can pass his finger through the external ring along the inguinal canal upwards and outwards into the internal ring, and thus into the abdominal cavity, although in old herniæ, the two rings are brought closer in apposition than in the more recent. In *direct* inguinal, the finger having passed the external ring, seems to enter at once into the abdominal cavity, the opening being directly behind the external ring, and, with the finger passed through the neck, the external border of the rectus muscle may be felt on the pubic bones. By these points the *diagnosis* between the acquired oblique and the direct inguinal can be made out.

Difference between congenital and acquired forms of oblique inguinal.

With respect to the points of difference between the "congenital" and "acquired" form of oblique inguinal hernia, a few words are needed, and may be thus epitomised. The "congenital" form is *the* hernia of infancy and young adult life, the "acquired" that of middle life and old age. A hernia that has formed *suddenly, and passed at once* into the scrotum, is probably of the "congenital;" whereas one that has been produced slowly is more likely to be of the "acquired" form. When the hernial tumour envelops the testicle and renders its detection impossible or difficult, the "congenital form" is indicated. When the testicle is in its right place and distinct from the hernial sac, the "acquired."

A hernia with a long tubular neck occupying the inguinal canal is probably of the "congenital" kind, a short thick neck being more common in the "acquired."

The youth of the patient, the rapidity of its formation, and its close connection with the testicle, are the three chief points characteristic of the "congenital" form of hernia. The age of the patient, the slowness of its production, and its distinct separation from the testicle, the three points indicative of the "acquired."

Diagnosis of inguinal hernia.

The diagnosis of an inguinal hernia from other tumours is only difficult in exceptional cases. No scrotal tumour beginning in the scrotum and developing upwards can be a hernia, for all herniæ descend towards the scrotum. So, when a distinct separation exists between the scrotal tumour and the external ring no difficulty in diagnosis ought to be experienced. In this way ordinary hydroceles, hæmatoceles, and all diseases of the testicle are excluded.

Hydrocele and its varieties.

When a *hydrocele*, however, passes through the external up to the internal ring, a condition by no means uncommon in infancy and young adult life, when the vaginal process of peritoneum is only closed at its abdominal orifice, some difficulty may be experienced; but in the absence of all symptoms of hernia, the translucency of the tumour, and the history of the case, viz. that the swelling began below and travelled upwards, are sufficient to point out the nature of the affection.

Congenital hydroceles into the vaginal process are to be distin guished from congenital hernia by their transparency, by the gradu filling of the sac, and by their vibration on percussion, whereas hernia is opaque, enters the sac rapidly, leaves it quickly, and does n vibrate.

An *encysted hydrocele* of the cord appears as a tense, fluctuatin transparent, irreducible tumour, and ought not to be confused wit a bubonocele when no other symptoms of hernia exist beyond th swelling.

Varicocele. The wormy feel of a *varicocele* or varicose spermatic veins, and th fact that pressure sufficient to keep any hernia in position with th patient erect over the external ring renders the varicose veins mo marked, should prevent it being mistaken for a hernia. And if th

Undescended testicle. Surgeon would only look for the two testicles in every case of scrot or even inguinal swelling, he could not fall into the error of mistakin an undescended testicle, or one resting at the internal ring or in th inguinal canal, for a hernia or any other disease.

Hernia and hydrocele combined. When a hernia and hydrocele coexist, some difficulty may be exp rienced in the diagnosis; but, as each affection has its own symptom the diagnosis ought not to be very difficult.

Whenever a doubt in diagnosis is felt about an inguinal tumour an symptoms of a strangulated hernia are present, the golden rule i surgery should be observed, and the doubtful tumour explored.

I had an interesting case (Feb., 1872) with the Messrs. Toulmin Clapton, illustrating this, in a boy, æt. 4, who had an acute hydr cele associated with a sudden descent of a hernia into the vagin process of the peritoneum of the cord. I tapped the hydrocele and le the inguinal tumour, thinking it might be possibly a hydrocele the cord, as no symptoms of strangulated bowel were present. The however, soon appeared, and chloroform was given with a view of e ploring the tumour, when, by the taxis, the hernia was happily reduc and the boy recovered.

Inguinal hernia in female. *Inguinal hernia is very common in the female child;* indeed, unde puberty, it is the usual kind, and is always of the "congenital form, the bowel coming down into the open canal of Nuck. It is found however, at all periods of life, though as a direct hernia it is rar seen in the adult. The rupture may consist of the ovary, and descen into the labium. It can be recognised by the same symptoms as i the male, and should be treated on the same principles. A hydrocel of the cord may be mistaken for a hernia.

Treatment of inguinal hernia. When reducible. TREATMENT.—A reducible inguinal hernia is to be kept up with truss, whether in the infant, child, or adult; the truss, too, must be well *fitting*, exerting sufficient pressure to keep the hernia in position, i *no more*. In the adult the truss should always be moulded upon a cas of the groin taken with the hernia reduced. Should the hernia come down when the truss is on, it ought to be reduced, and the truss re-applied. The

Cure in infants. pressure of the pad in the oblique form should be over the *internal*; but in the direct, over the *external ring*. In infants a complete cure is often obtainable by these means in a year or so, and if no descent or any other symptom of hernia shows itself for another year, the truss may be left off. In cases of hernia occurring after infancy it is, however, never safe to leave off a truss. When some malposition of the testis complicates a case of the congenital form of hernia, care must be taken that the

pad of the truss does not press the testicle, and when the testicle and hernia are both in the inguinal canal the only truss that can be tolerated is one made upon a cast of the parts after rest, as already advised in page 740.

Irreducible, inflamed, obstructed, and strangulated inguinal herniæ are to be treated on the principles already stated.

A strangulated *direct* inguinal hernia is, however, a far more serious affection than the *oblique*, the sharp unyielding edge of the ruptured tendon surrounding the neck of the sac acting as rapidly upon the strangulated bowel as does the edge of Gimbernat's ligament in femoral hernia.

When a hernia cannot be kept up with a truss, the question of the operation for the *radical cure* of the hernia may be entertained. The operation has its dangers, and Wutzer, its early, and Wood its present advocate, admit that a truss is necessary subsequently throughout life. When irreducible.

The Radical Cure of a Hernia.

This has been the aim of Surgeons from time immemorial; and were hernia only a mechanical lesion due to a weakness of the walls through which it protrudes or of the neck of the sac, some success would probably have attended the practice; but as a rupture is more probably due to something more than this, it can hardly be expected that any very good result should have been obtained. Gerdy, Wutzer, Rothmund, Wells, and Davies, have all tried to accomplish this by plugging the mouth of the sac with its invaginated fundus, Gerdy fixing the invaginated fundus by means of two sutures; Wutzer, by means of a cylindrical wooden plug, passed into the inguinal canal in the hollow of the invaginated structures up to its neck, and a grooved wooden pad being applied externally over the first, to hold the parts in position, the two wooden instruments being held together by a needle (which is enclosed in the cylindrical part, and made to pass through the internal ring and external tissues) and a screw; the plug should be retained for six or seven days. Rothmund, Wells, Davies, and others, have only improved upon Wutzer's method. Mr. Birkett, however, tells us on the authority of Dr. Otto Weber, of Bonn, the late clinical assistant to Wutzer, that Wutzer is still of opinion that his operation is not dangerous when properly performed, and that by his method the fundus of the invaginated sac may be made to adhere to its neck, and as a consequence of this, *if the patient continue to wear a truss for life, a return of the hernia may be avoided.* Dr. O. Weber, moreover, writes that he has never seen any of the so-called "cured cases" radically cured; that the plug of skin is by degrees entirely drawn out again; that the external and internal rings are not closed by the operation; that an imperfect cure may be effected by means of a partial closure by adhesion of the internal walls of the neck of the sac and thickening of the surrounding tissues. In London practice it is also well known that a fatal peritonitis has followed the attempt. With these facts before us respecting Wutzer's operation I cannot recommend it. On the radical cure of hernia. Weber's statement as to its inefficiency.

Mr. Wood, of King's College, believing that Wutzer's principle of practice was as wrong as his practice was unsuccessful, devised in 1863 an operation by which the hernial sac, without the skin, is invaginated into the canal, and the hinder and inner walls of the inguinal canal are drawn forward by means of sutures, and fixed to the anterior and outer walls.

The steps of the operation are conducted as follows. They are taken from Druitt's 'Vade Mecum,' as revised by Wood:

Wood's operation for the radical cure.

The patient being laid on his back, with the shoulders well raised, and the knees bent, the pubes cleanly shaved, the rupture completely reduced, and chloroform administered, an oblique incision, about an inch long, is made in the skin of the scrotum over the fundus of the hernial sac. A small tenotomy knife is then carried flatwise under the margins of the incision, so as to separate the skin from the deeper coverings of the sac, to the extent of about an inch, or rather more, all round. The forefinger is then passed into the wound, and the detached fascia and fundus of the sac invaginated into the canal. The finger then feels for the lower border of the internal oblique muscle, lifting it forwards to the surface. By this means the outer edge of the conjoined tendon is felt to the inner side of the finger. A stout semicircular needle, mounted in a strong handle with a point flattened antero-posteriorly, and with an eye in its point, is then carried carefully up to the point of the finger along its inner side, and made to transfix the conjoined tendon, and also the inner pillar of the external ring. When the point is seen to raise the skin, the latter is drawn over towards the median line, and the needle made to pierce it as far outward as possible. A piece of stout copper wire, silvered, about two feet long, is then hooked into the eye of the needle, drawn back with it into the scrotum, and then detached. The finger is next placed behind the outer pillar of the ring, and made to raise that and Poupart's ligament as much as possible from the deeper structures. The needle is then passed along the outer side of the finger and pushed through Poupart's ligament, a little below the deep hernial opening (internal ring). The point is then directed through the same skin puncture before made, the other end of the wire hooked on to it, drawn back into the scrotal puncture, as before, and then detached. Next, the sac at the scrotal incision is pinched up between the finger and thumb, and the cord slipped back from it, as in taking up varicose veins. The needle is then passed across behind the sac, entering and emerging at the opposite ends of the scrotal incision. (Fig. 282.) The end of the inner wire is again hooked on, and drawn back across the sac. Both ends of the wire are then drawn down until the loop is near the surface of the groin above, and are twisted together down into the incision, and cut off to a convenient length. Traction is then made upon the loop. This invaginates the sac and scrotal fascia well up into the hernial canal. The loop of wire is finally twisted down close into the upper puncture, and bent down to be joined to the two ends in a bow or arch, under which is placed a stout pad of lint. The whole is held steady by a spica bandage. (Fig. 278.) The wire is kept in from ten to fourteen

Fig. 282.



From Wood.

days, or even longer, if the amount of consolidation is not satisfactory. Very little suppuration usually follows, but after a few days the parts can be felt thickened by adhesive deposit. The wire becomes loosened by ulceration in its track, until it can be untwisted and withdrawn *upwards*. In this operation the hernial canal is closed along its whole length, and an extended adherent surface is obtained to resist future protrusion.

Treatment after the operation.

After the operation, Wood says, a horse-shoe pad should be worn for a few months, *and the truss is not to be thrown aside when the patient is about to be subjected to violent strains or lifting.* This is important to remember; though it tends much to do away with the value of the operation.

Modifications of the operation are employed for infants, &c.

Wood's statistics of the operation.

The operation I have described is a subcutaneous one and is ingenious. It has, moreover, its dangers. Wood writes he has operated 337 times with four deaths, and out of 107 cases in which the results were known, in 48 a failure followed, and in 59 a satisfactory result was secured. Thus, in the most favorable light, there is one failure to one success, and risk to life. It is to be feared, however, that a large number of these so-called satisfactory cures are only so when they leave the operator's hands, since Kingdon's Reports of the City of London Truss Society tell us, that within ten years, fifty persons who had undergone some operation for the radical cure had, in consequence of its failure, applied for trusses; and this number is large, considering the surgeons who perform this operation are not numerous, nor the cases abundant.

When the operation is uncalled for.

For my own part, I believe, that where a hernia can be kept up by a truss, and the patient is likely to remain in a civilised country where trusses can be obtained, an operation for the radical cure is not called for. To risk the life of a patient on the theory of a cure, when a truss, as a matter of safety, has to be worn subsequent to the operation, is both unfair and unsatisfactory.

When the operation may be justifiable.

When a hernia is reducible and cannot be kept in place by a truss; when a patient is going abroad where trusses are not to be obtained, or only obtained at too great a cost, the operation for the radical cure may be undertaken. Indeed, under these circumstances I have performed Wood's as well as Wutzer's operation with good success; that is, the patients who previously could not keep up their hernia on account of the great size of the inguinal ring were enabled to do so.

In the "congenital form" of inguinal hernia, there seems a better prospect of success following the operation than in any other, and a better basis for the practice; for "thus allowing nature to guide our procedure, we must make it a rule to select those cases in which her efforts have failed; and by acting as her handmaid, we may reasonably hope to arrive at a successful result." (Birkett.)

Spanton's operation.

The corkscrew operation known as that of Mr. Spanton, of Hanley, is another subcutaneous operation, of which I have had no experience. It seems to have been successful, more particularly in children, and is worthy of an extended trial.

Mr. Spanton's object in his operation is to fill the canal itself with organised tissues, and at the same time to approximate its tendinous boundaries. The operation I describe nearly in Mr. Spanton's own words.

The instruments required for the operation are a narrow bladed knife

Spanton's operation.

for making the scrotal incision, dressing forceps and the screw instrument (or strephotome) shaped like a corkscrew with a wide spiral, which tapers somewhat towards its base. The point is flattened, but sharp so as to transfix the tough tissues without tearing; and the handle consists of a movable bar which it is sometimes convenient to leave in position so as effectually to steady the instrument. In cases where it is intended to use a ligature by means of the screw, a glass rod perforated with two holes at each extremity will be required for fastening the ends of the ligature. The patient should have an aperient and an ordinary enema previous to the operation, and, if necessary, the pubes should be shaved. The patient being anæsthetized, the operator standing on the patient's left, makes an incision large enough to admit the forefinger through the skin of the scrotum over the fundus of the hernial sac, usually an inch and a half or two inches below the pubic spine. The sac with the fascial tissues covering it is then separated from the skin by passing the knife or handle freely around the internal surface of the wound, until a sufficient extent of it has been separated to permit the finger easily to invaginate the sac into the hernial canal, which is readily accomplished by pushing the sac with the left forefinger up to the internal ring After carefully examining the condition of the parts within reach of his finger—especially with regard to the position of the blood-vessels, and the boundaries of the aperture—the operator retains his forefinger in the inguinal canal, thereby protecting the spermatic cord which lies below his finger, and at the same time closing the internal ring so as to prevent any protrusion of the bowel. Sometimes with a very patent ring it is necessary for an assistant to place his finger externally on the groin to make perfectly sure of this —especially if there is any cough or struggling. It is, however, wiser to wait a few moments, and to let the patient become quiescent before proceeding further. Then, holding the "strephotome" firmly in the right hand, the Surgeon thrusts the point through the skin of the groin at that part of the surface which corresponds to the outer pillar of the internal ring, which is also pierced by the point which now comes in contact with the left forefinger. Having given the screw a turn, the point is made to pierce the invaginated sac, and pushed on through the internal pillar (conjoined tendon) as high up as can be safely reached, the left forefinger carefully guarding the point of the instrument throughout. Another turn is now made, causing the screw to pass through the invaginated tissues and across the pillars of the external ring as many times as the length of the canal and the nature of the case will permit. The left finger is gradually withdrawn as the point passes downwards and outwards through the opening in the scrotum, the spermatic cord lying behind, and slightly compressed by the gradual tightening of the hernial canal. The point of the screw is then protected by a small india-rubber ball, and the handle lies flat on the outer surface of the abdomen. The scrotal wound is closed by a single wire or hair suture. A pad and soft bandage is then applied over the whole.

Removal of instrument.

After a few days—usually seven to ten—the parts become sufficiently consolidated, and the screw is then removed without any difficulty, and an oiled pad and bandage kept applied until the parts are firm.

If a continuous ligature is preferred, the screw with a large eye at the point is passed in the manner already described, then threaded with the ligature when the point appears through the scrotal opening, and

the screw is gradually withdrawn upwards, the ligature following its track and occupying its place. In order to keep the ligature tight each end is fastened to a glass rod, which lies on the groin until the parts are consolidated—ten to fourteen days usually—the ends are then cut off and the ligature remains. After the operation a pad should be worn as a support and to give time for the parts to become consolidated.

The most satisfactory cases are those of congenital herniæ in the young, and this operation is especially adapted for those in which the hernial aperture is large and the sac bulky, or where a congenital rupture is of old standing. The more tissue we can securely invaginate, the better the result as a rule, and when the pillars are soft and lax, it is easier to bring all the parts firmly together, and to secure a firm, unyielding barrier. Experience alone can teach which are the most suitable cases for each operation. Mr. Spanton tells me that he has operated in over 60 cases and has had no death.

When ligature is used.

Within recent times an *open operation*, a method by dissection, has grown in favour, and I for some years have employed it in preference to Wood's operation. It consists of cutting down upon the sac, dissecting it out, tying its neck with carbolised gut or silk sutures, excising the fundus of the sac, and stitching up the abdominal rings with good silk or wire sutures. Where omentum is present I cut it off, after applying a ligature to its neck. In fact, as an operation for the radical cure of a hernia I do what I and most of my colleagues at Guy's have for years done after an operation of herniotomy with good success. Wood tells me he has recently performed a like operation in about 53 cases with a good result. This open operation has been ably advocated by Banks, Guénod of Basle, Annandale, Franks, and others. Banks employs silver sutures.

Method by dissection.

References.—Banks, 'Brit. Med. Journ.,' Nov. 13th, 1882; *Annandale,* 'Edin. Med. Journ.,' vol. xxvi; *Guénod,* 'Thèse de Basle,' 1881; *Franks,* 'Med. Press,' Jan., 1884.

Femoral Hernia.

On femoral hernia.

This forms about one tenth of the whole number of cases of hernia, and about forty per cent. of all cases of strangulated hernia. It is also far more liable to become strangulated than inguinal, and less likely to be reduced by the taxis. The taxis, moreover, is more prone to produce injury. Thus, one out of three cases of strangulated femoral hernia is reducible by the taxis, two being operated upon, and of these 40 out of every 100 die; the operation after "recent hernia" being twice as fatal as it is after the "old"—a strangulated femoral hernia going on more rapidly to destruction than any other, and a strangulated "recent" than an "old" hernia.

More liable to strangulation.

Anatomy of the hernia.

Femoral hernia descends from the abdominal cavity through the crural ring *inside* the femoral vessels. The free margin of Gimbernat's ligament bounds its inner side, and the sac which is always acquired, pouches downwards beneath Poupart's ligament and emerges through the saphenous opening to the inner side of the falciform process of the fascia lata. The hernia expands laterally, resting upon this fascia, and, as it enlarges, turns upwards over Poupart's ligament, then in the direction of the crest of the ilium, very rarely spreading downwards. Its long diameter will be transverse and not vertical. The neck of the hernia will always lie *outside* the spine of the pubes or the tendon of the long adductor, while an inguino-scrotal or labial hernia

Situation of vessels.

will always be found *inside* these points. The deep epigastric artery and vein usually lie outside the neck of the sac, and are free from harm in the operation; though when the obturator comes off from the epigastric, and arches over the neck of the hernia to dip down on its inner side towards the obturator foramen, it may be divided when a *free* incision is made.

Rare cases of femoral hernia occur external to the femoral vessels, as related by Partridge ('Path. Soc.,' vol. i), as well as through Gimbernat's ligament, or with a diverticulum through the cribriform or superficial fascia. (*Vide* Birkett.)

Diagnosis of femoral hernia.

Diagnosis.—The points already stated will enable the student to distinguish a femoral from an inguinal hernia.

Psoas abscess.

A psoas abscess dilates on coughing, and disappears or diminishes on the patient lying down, just as does a hernia; but it is usually placed beneath and outside instead of inside the vessels. It is often accompanied also by spinal symptoms; and, on manipulation, gives the sign of fluctuation from above to below Poupart's ligament.

Varix.

A varix of the femoral vein may also in a measure simulate a hernia; but, whereas in a hernia, with the patient erect, pressure over the crural ring and vessels will prevent its descent, in varix it will cause its enlargement.

Enlarged gland.

An enlarged gland ought not to be mistaken for a rupture, as the history of the case and concomitant symptoms generally mark its nature.

Cysts.

Cysts in the crural ring are doubtless difficult to diagnose, although from their always being in the same spot under all circumstances, and from their not being influenced by position, coughing, &c., they are unlike hernia. When associated with a strangulated hernia they may complicate the case, but seldom lead to error.

Treatment of femoral hernia.

TREATMENT.—Reducible hernia can be treated by a truss, the pad pressing in the hollow below, and external to the spinous process of the pubes. The radical cure has been performed by Wood, Wells, and Davies, but it cannot be recommended.

Strangulated femoral hernia requires the most prompt attention, for the parts constricting the neck of the sac are so unyielding as to produce in a short period an amount of damage which is too often irreparable. In the application of the taxis, the utmost gentleness should be employed, and the administration of an anæsthetic should always precede the attempt. In the reduction of an old femoral hernia, the taxis rarely succeeds.

Caution with taxis.

Mode of using taxis.

In reducing a femoral hernia by the taxis, the Surgeon should always remember the position of the orifice of the sac, for when it has turned over Poupart's ligament, any pressure on the tumour can only do harm. The tumour should be gently raised by the fingers, and drawn slightly downwards and to one side before pressure is applied, which must be of the mildest kind. If the slightest disposition to yield be shown, the pressure may be continued, because when any of the contents of the sac are emptied, the probabilities of the reduction of the whole are greatly enhanced. If no yielding be felt in the parts, the taxis had better be given up, and the operation performed.

On opening the sac.

In all operations for femoral hernia, the reduction of the hernia without opening the sac should be preferred, and, in "recent" hernia this "minor" operation is generally successful. The incision to expose the sac consequently should be a limited one. Lake suggested that

having remained quite well till December 3rd, though for the last three months she had been in much reduced circumstances. On December 3rd she was again violently sick, and had much pain in the *left side* of the abdomen, which was increased on passing a motion. The bowels were confined and the fæces small. She had now a double femoral reducible rupture. Her abdomen was natural, and a rectal examination showed nothing abnormal. She was placed under the influence of opium, when the sickness ceased and the bowels acted. On January 6th, however, the symptoms returned. She was again sick, and had much pain in the left side of the abdomen, while the temperature rose to 101° F. From that time she gradually sank. The bowels were not again relieved, the abdomen became tympanitic, and the vomiting only ceased a few days before death, which took place on February 4th, with increasing exhaustion. She had at no time anything like obturator pain, and though all the regions of hernia were carefully examined, nothing was noticed to suggest the disease.

Autopsy by Dr. Goodhart.—The body was very emaciated; there was no marked distension of the abdomen; the peritoneum was injected all over. A little pus was smeared over the coils in the neighbourhood of the cæcum, and in the pelvis, two ounces of pus or more had gravitated to the bottom of Douglas's pouch. No evident source of the pus could be discovered, though it is probable that it arose from peritonitis, due to over-distension of the bowel. The small intestine was only moderately distended, but crammed with pultaceous, yellow, fæcal contents, and the coats were somewhat thickened. Following it downwards, the distension continued till two feet from the cæcum, where a piece of the bowel passed through the left obturator foramen (Fig. 284). Below this the intestine was very contracted. The aperture in the obturator foramen was not large, and the intestine did not appear to be nipped in any way. A knuckle of bowel was in the sac, but the passage onward would not allow of the introduction of the little finger. The bowel was intimately adherent to the sac throughout, so that on opening the latter the bowel was wounded. The included bowel was greyish, but neither gangrenous nor inflamed. The mesentery was somewhat thickened at its neck, and within the bowel were some old ulcerations, as judged from the amount of thickening of the edges of an ulcer found at the neck of the hernia. The ulceration, however, was not within the neck, but rather on the opposite unincluded surface of the intestine. The sac pushed the obturator nerve and vessels well to the outer side and to its upper part, with the exception of one branch of artery, which passed to the thigh on the inner side. Autopsy.

The obturator muscle, which was in front of the sac, had to be scraped away to get at it. The sac was of nodular shape, and about two thirds of an inch in diameter (Fig. 283). It caused no fulness externally on the thigh. This was looked for particularly, because the protrusion was first discovered from the inside. In addition to the hernia, another coil of bowel (small intestine considerably higher up) was adherent by a strong band at the hernial neck, and about this the distended coils had twisted in a peculiar and indescribable manner, yet no obstruction had resulted therefrom, the distension continuing both above and below it. A slight femoral protrusion also existed on both sides. On the right side, a little omentum was adherent at the

neck of the sac, and, by its adhesion, dragged down the pyloric orifice of the stomach and the textures in the portal fissure.

Death, in this case, was clearly due to chronic intestinal obstruction, caused by the adhesions of the bowel to the hernial sac. The only special symptom worthy of notice was, the fixed pain in the left side of the abdomen above Poupart's ligament.

FIG. 283. FIG. 284



External view. Internal view.

Obturator hernia.

Treatment of obturator hernia.

TREATMENT.—The taxis can hardly be expected to be a successful proceeding in obturator hernia, the sac being so low down in the thigh and so little under control. Nevertheless it should be tried, with the adductors relaxed by means of steady pressure applied downwards in the hollow of the thigh, and inwards between the adductors.

Operation for obturator hernia.

To explore the parts an incision should be made below Poupart's ligament, and to the inner side of the femoral vein, down to the pectineus muscle, which may then be divided. If no sac appear, and the obturator foramen covered by its muscle be reached, the fibres of this muscle must then be separated, and the obturator canal found; for a small hernia, as proved by the case I have recorded, may be hidden completely by the muscle. When a sac is felt the parts constricting it must be divided by a knife, and its contents reduced. The obturator nerve, if possible, should be avoided.

Umbilical Hernia.

On umbilical hernia.

This may be a congenital or acquired affection, and is common in children from want of closure of the umbilicus. It is far from rare in fat women, and others who have had many children. It is also met with in men, forming 5 per cent. of all cases of hernia, and 6 per cent. of cases of strangulated hernia.

Congenital umbilical hernia.

The Congenital Form.—Children are occasionally born with a hernial protrusion of some of the abdominal viscera into the umbilical cord, the covering of the viscera consisting of the thin translucent sheath of the cord; this deformity is probably due to an arrest of development. Among the few examples of this affection that I have seen

was one in which the liver projected, and in it the serous covering subsequently granulated, contracted, and so pressed the parts back into their normal position that a recovery followed. Fig. 285 represents the case in the fifth month. In the case of a male child, one day old, in which a hernia into the cord the size of a small egg existed, and through the thin walls of which the cæcum with its appendix was clearly visible, I pressed the bowel back with my finger and thumb,

Fig. 285.



Congenital umbilical hernia.

stitched up the cord at its umbilical orifice with some deep sutures and ligatured the cord itself at the apex of the congenital translucent hernial sac, and complete recovery followed without any bad symptoms. The child was alive and well two years after the operation. The case was brought to me on June 16th, 1876, by an old dresser, Dr. W. Cock, of Peckham. The practice adopted in the case is that which I advise to be followed.

The acquired form.

In the acquired form of hernia the *sac* is always formed, both in the infant and adult, by the pushing forwards of the parietal abdominal layer of peritoneum. The parts covering it, being occasionally very thin, are only integument and fascia, the internal abdominal fascia being over the true sac; at times the tumour attains a large size, and, as it generally increases *downwards*, the Surgeon must look for the neck of the sac at its upper part. These herniæ at times assume odd shapes.

Treatment of umbilical hernia.

Umbilical truss.

Treatment.—When in an infant and reducible, a cure may with some confidence be promised; indeed, with the majority of cases in young life an opening in the navel will contract, if care be observed to fix with good strapping a *flat* elastic ring or pad covered with leather over the part. A convex pad tends to keep the ring open. A belt or truss in early life is a delusion, since it never keeps its place. In lieu of a pad it is an excellent plan to pinch up the integument over the hernia with the thumb and finger, and then to turn the folds sideways upon the umbilical opening, fixing it in its position by waterproof strapping, the folded integument by this method acting as a pad and assisting recovery.

complete recovery took place. I have followed this practice on several occasions with a similar result. A *double sac* is found at times in umbilical hernia. Some time ago I was called on to operate in such a case. The woman was aged 44, and had been ruptured for years, the hernia being irreducible. She came under my care at Guy's, with symptoms of two days' strangulation. The rupture was clearly inflamed, the slightest manipulation causing intolerable pain. Under chloroform I cut down upon the tumour, and found two distinct sacs, their orifices, which were placed laterally, being separated by a piece of dense fibre tissue. One contained a mass of omentum, the second intestine, which was black from congestion, and covered with lymph. The orifices of the sacs were freely divided, and their contents left, but the patient died, and no examination after death was allowed. In another case I found strangulated bowel in a small omental sac introduced into an irreducible hernia.

When a double sac exists.

A ventral hernia is a term applied to any protrusion through the abdominal walls not belonging to the usual forms. Most of these are found in the linea alba above the navel. One of the largest I ever saw was over the right iliac fossa, and followed a rupture of the abdominal muscles caused by a fall of twenty feet upon the handle of a pump; it was the size of a man's hand, and strangulated. By the taxis I reduced the mass, and by the use of ice locally and opium internally the man recovered. He had, however, subsequently to wear a pad to support the part.

On ventral hernia.

After the operation of ovariotomy a very large protrusion may take place, if a good belt be not worn. The same may arise after the weakening of the abdominal walls from abscess.

When the hernia takes place below the xiphoid cartilage it is called *epigastric*, and in the loins *lumbar*. Birkett quotes two such cases. In 1875 I saw an example of the epigastric form with Mr. Treves, of Margate, in a lady, æt. 68, who had at the same time an irreducible umbilical hernia. Symptoms had existed for 108 hours when I operated, and the bowel slipped back unseen on dividing the parts at the neck of the sac. The patient, however, sank.

Perineal hernia descends in front of the rectum, and appears in the perinæum, and is most common in women. When the hernia descends outside the vagina, along the ramus of the ischium, it shows itself in the labium, *labial* or *pudendal hernia*, and when it appears in the vagina, *vaginal hernia*.

On perineal hernia.

Vaginal and labial herniæ may be mistaken for the mucous cysts of those parts; but the herniæ are reducible, and when irreducible or strangulated they give rise to symptoms indicative of these conditions. The cysts are only local affections, and cause no general symptoms. They are tense, elastic, globular tumours, fixed in the tissues, and have *no neck* passing upwards into the pelvis.

Ischiatic hernia is a hernia through the sciatic notch, above or below the pyriformis muscle. The gluteus maximus muscle covers it in; but, as the hernia enlarges, it may appear below the lower border of that muscle. Dr. F. C. Crosse, in Sept., 1873 ('Dublin Journal of Medical Science'), has recorded an interesting example of this kind in a woman æt. 40. The tumour occupied the lower border of the right gluteal fold; it was the size of a fœtal head, soft and pulpy to the touch, dull in parts, tympanitic in others; and coughing gave an impulse

On ischiatic hernia.

to it. It was treated by a truss. When a rupture of this sort be strangulated an operation must be performed, the Surgeon making an incision as will best expose the tumour and its neck.

On diaphragmatic hernia.

Diaphragmatic hernia is met with as the result of an ac (traumatic), and is generally fatal; it has been alluded to und heading of "Abdominal Injuries," page 694. It may also be the of some "congenital" defect, or the pushing of the abdominal v through a natural or other opening in the muscle (acquired form rarely calls for surgical aid.

On Trusses.

Composition of truss.

A truss is an instrument employed for the purpose of preventi descent or enlargement of a hernia. It is composed of a pad, to be over the seat of the hernial protrusion, and a spring or belt to kee position. Any truss that will keep up the hernia under all circumst and does not cause pain or lasting discomfort, is probably ben Every truss that fails to carry out this object should be conde An instrument with a too feeble spring is a delusion and snar one that is too powerful may tend to do more eventual harm present good by causing absorption of the abdominal parietes, which it presses, and, as a consequence, enlargement of the op through which the hernia descends. For the same reason a pad unduly convex is also to be condemned.

A pad to be efficient and comfortable should be moulded upon of the part to which it is to be applied, since no two groins are When this is done the most perfect and most comfortable tr provided (Fig. 272A, p. 740).

When to be worn.

Every subject of a hernia, young or old, male or female, should a truss, and, in a good proportion of cases, particularly of the y a cure may take place; that is, the neck of the sac may close. even after a cure, or apparent cure has taken place, it is well, f sake of safety, to wear the instrument; as cases are far from quent, when a supposed cure had taken place, and after the la years, a sudden descent has occurred, jeopardising life. This more common in the congenital form of hernia.

The truss should be worn all day, from the act of rising out o to that of retiring, as its object is to prevent the descent of the under any sudden act of exertion, and, with the truss off, it is i sible to guarantee that any such may not be made. Some pa habitually remove their trusses when they are sitting in their dra room, but this practice is to be condemned, since I have more once been called upon to treat a strangulated hernia which came during some unguarded act under these circumstances; and it these unguarded moments that the truss is calculated to be of so benefit.

When the truss is first applied, it will doubtless cause some i venience; with the moulded truss this is very slight. The use of p of starch or violet powder, the bathing of the point of pressure some spirit and water, and attention to keep it very dry, are exc remedies for any little local source of discomfort.

On the pad of a truss.

The Pad.—This should be regulated according to the size o hernial aperture. A small opening requiring a small pad, and a

opening, a large one. The pad should always overlap for about half an inch all round the hernial aperture, and in large herniæ, for more. It should be adapted to the individual groin, and made flat or concave according to its anatomy. It should also be so adapted to its spring as to keep its place under all circumstances.

In inguinal hernia it should, moreover, be so fixed to the spring as to exert a pressure at right angles to the plane of the hernial aperture. Thus, in large pendulous bellies, the pressure may be upwards, or inwards and upwards; but in thin subjects directly backwards. In femoral rupture, the pressure should always be backwards, in order to close the crural ring. Any truss that applies its pressure only in one direction, must fail in its purpose in a large number of cases. It is, indeed, in this curve of the spring, or direction in which the pressure of the pad is employed, that the chief difference in the great varieties of trusses is found. In inguinal hernia. In femoral.

Some pads are rigidly attached to the spring that holds them in position, while others are connected by means of moveable joints of different construction. Salmon and Ody's well-known truss has a ball-and-socket joint, as has the excellent champion truss of America.

The spring of a truss is a matter of importance, although not so much as the pad and the direction of the line of pressure. Its strength should be carefully regulated according to the requirements of the individual case. It ought to be strong enough to keep the pad in position, and prevent the descent of the hernia under all circumstances, but not so strong as to cause pain. The French spring consists of a coil like that of a watch-spring, is always in action, and presses inwards. The German form is more rigid and inelastic, and holds the pad firmly in its place, thereby resisting the protrusion of the hernia under any expulsive effort. The English makers employ a variety of springs. A too rigid one, as the German, is not to be recommended, whilst the French is also objectionable, its action being too severe and constant. On the spring of a truss.

The best is that which holds the pad in position, keeps it there under all movements, counteracts any expulsive action of the hernia, and causes little if any discomfort. The lighter it is under these circumstances the better, and the closer it is adapted to the body the more comfort it affords.

The only truss that has no circular-body spring, and is kept in position by a band is the Moc-main lever. The pressure is kept up by means of a thigh-strap attached to a small spring-lever connected with the pad. Such a truss is doubtless comfortable, as its action is not enough to produce inconvenience, but it is not safe under most circumstances. In old people, where the inguinal rings require only a little support, it may be used; but in the middle-aged, when the hernia has a tendency to come down, it is a dangerous and unreliable instrument. The Moc-main lever.

In oblique inguinal hernia the pad of the truss should be placed *over the internal ring and canal*, and not over the external ring, the object being to give support to the weak internal ring; in direct inguinal it is placed over the external ring. In femoral hernia, when the crural arch is natural and not relaxed, a small pad may be employed over the neck of the sac; but when the arch is relaxed and moveable, a Situation of pad of truss on rings.

large pad, so adjusted as to press upon the ligament itself, is required. After the operation of herniotomy for crural hernia, this fact is worthy of attention; for when a free division of Gimbernat's ligament has been made, the neck of the sac is always large, and the ligaments relaxed.

Varieties of truss.

To give a description of every variety of truss is needless. *Egg's truss* is in all respects rigid, and keeps its place when once fitted. *Coles's truss* is very good, is light, and has a thin metallic pad covered with leather, and acted on by spiral rings. When properly adapted with a not too convex pad, it gives elastic pressure; but is not so well calculated to retain a hernia under violent exertion as another truss with a more solid pad; the elastic pad being apt to yield and allow the hernia to descend. This objection applies to all elastic pads, although air or water pads, in some cases, are very comfortable and valuable, particularly in the healthy aged subject.

Among the trusses with solid pads that of Wood's must be mentioned. They are made by Matthews, with flat pads, composed of wood, ivory, or vulcanite, an india-rubber water-bag being occasionally applied to the surface of the pad. They are held in position by a spring that encircles the body. The size of the pad varies with the nature of the hernia, and the size of the hernial aperture. For oblique inguinal hernia, the pad is of an obliquely curved horseshoe shape, the outer limb over Poupart's ligament being shorter than the inner, and the spermatic cord and pubic spine lying in the cleft. The curve of the horseshoe is placed over the inner hernial aperture. For direct inguinal or umbilical hernia, the pad is made the shape of an ovate ring with a hole, corresponding to the hernial opening in the centre. For femoral hernia, the pad is egg shape. Newsom's truss has a thin round wire-spring and a hard pad, which is very comfortable when well adapted. The truss of Dr. C. Edwards, of Cheltenham, is good, the pad being so arranged, that it may revolve as well as slide on the spring when required. That of Salt, of Birmingham, and L'Estrange's are also good instruments. Down, late Milikin, of St. Thomas' Street, S.E., makes also an excellent truss, with a pad, which, being moveable upon a ball-and-socket joint, is readily adapted to any case.

Author's truss.

The best truss is without doubt the one already alluded to, with a pad made upon a cast of the groin of the individual requiring it, and fastened to a spring with adjustments like those of the American champion truss, as made for me by Messrs. Krohne. Page 740.

The main objects of a truss.

Whatever truss is selected to be of use it must answer to a nicety the purpose for which it is required. The pad should be adapted to the abdominal hernial orifice or to the hernial tumour itself, and not below it. The amount of pressure applied to the pad ought to be carefully regulated as well as its direction, and enough employed to keep the pad in position under all circumstances, without causing pain. A slight force applied in the right direction being of more value than a greater misdirected.

The pad may be flat, concave, or slightly convex, and made of a solid or elastic material. A metal one with wash leather taking the shape of the parts is the best. Sand pads covered are of value, as they can be moulded to fit more comfortably and accurately than many others. For an irreducible hernia (not scrotal) the pad should always

be framed upon a cast of the hernial tumour, taken when at its smallest, after rest. No other pad will keep its place.

To test the value of a truss.

To test the value of a Truss.—The patient should be made to cough and strain, and, when possible, to jump. He should be placed on the edge of a chair, with his legs apart, or made to stoop forward with his knees apart and his hands resting on his knees and then to cough, these positions tending more than any other to relax the lower parts of the abdomen and to loosen the truss. When the hernia by these means fails to descend or to excite in the patient a sensation of weakness in the region of one of the abdominal rings, the truss is probably efficient. The patient should be taught, under all circumstances, what the truss is expected to do, and be made to understand the danger he will incur if it fail in its purpose, as well as the necessity of again seeking advice.

The Surgeon, moreover, should always take upon himself the responsibility of seeing that the truss fits, and not rest satisfied by sending his patient to buy a truss where he likes and of what kind he likes; he should also tell the maker what is wanted, and not leave him to find it out.

To measure for a truss.

To measure for a Truss.—The following points should be noticed, viz. the nature of the hernia, the size of the hernial aperture, the side, or if double. The circumference of the pelvis should also be given one inch below the crest of the ilium, and the girth of the body, commencing and ending at the hernial orifice, as well as the distance from the hernial aperture to the iliac spine. The Surgeon, moreover, should always indicate to the maker the directions of the pressure required by the pad, and this should always be made out when the patient stands, by a digital examination. In pendulous and fat subjects with inguinal hernia, it may be upwards, backwards, and inwards; in thin subjects simply backwards. In femoral rupture, the plane of the crural ring is horizontal, and may be closed by a backward pressure. No general rules can be laid down, though this is a point upon which the whole value of the truss depends.

To estimate the force required to keep the hernia in position is a difficult matter. Up to the present time the only true test is that of trial. Mr. Wood has had an ingenious pressure-gauge made for the purpose, which may possibly turn out of value. ('Brit. Med. Journ.,' October 12th, 1871.) Mr. Holthouse has likewise invented a skeleton truss which promises to be of use for indicating the length and shape of the spring required, and the correct angle at which the pad should be fixed.

Extra spare truss.

Patients who are liable to employ at times great muscular exertion should have two trusses, one for ordinary wear with a sufficient press power to keep the hernia in position, and the second with an increase of power which is to be put on when occasion demands. They should also have extra bathing trusses.

When a double truss to be used.

When any tendency exists for a double hernia, as indicated by a bulging of the opposite ring or a sense of weakness on making exertion, a double truss should be worn; indeed, in inguinal hernia, I believe that a double truss should always be employed. It is at least as comfortable as a single one, besides being an extra protection if well adjusted, certainly it can do no harm.

Birkett, 'Holmes's Syst.,' vol. ii, 3rd ed., 1883; 'Med.-Chir. Trans.,' 1859.—*Bryant*,

'Guy's Reports,' 1856; 'Clin. Surg.,' part 3, 1861.—*Cooper's* 'Surgical Dict.,' 8th ed.—*Gay*, 'On Hernia,' 1848.—*P. Hewett*, 'Med.-Chir Trans.,' 1844.—*Hutchinson*, 'Lond. Hosp. Rep.,' 1865.—*James*, 'On Hernia,' 1859.—*Aston Key*, 'On Hernia,' 1833; 'Guy's Rep.,' 1842.—*Kingdon*, 'Med.-Chir. Trans.,' 1864.—*Luke*, 'Med.-Chir. Trans.,' vols. xxvi and xxxi.—*Lawrence*, 'On Ruptures,' 1835, 5th ed.—*Stephens*, 'On Obstructed Hernia,' 1829.—*Scarpa*, Wishart's ed., 1814.—*Ward*, 'On Strangulated Hernia,' 1854.—*Wood*, 'On Rupture,' 1863.

CHAPTER XVI.

SURGERY OF THE ANUS AND RECTUM.

(Malformations.)

Varieties of malformations of anus and rectum.

THE anus and rectum are not rarely the seat of congenital malformations, which show themselves in a variety of forms. In one the anus is imperforate, the rectum being either partially or wholly deficient; in a *second* the anus exists in its normal condition, but opens into a *cul-de-sac*, the rectum being partially or wholly deficient (Fig. 286); and in a *third* the anal orifice is absent, the rectum opening into the bladder, urethra, vagina, or other abnormal position. And, it will be observed, says Mr. Curling, to whom we are indebted for the bulk of our information on this subject ('Med.-Chir. Trans.,' vol. xliii), that the classification of these imperfections is founded on states that can generally be recognised during life; although, unfortunately, the conditions of the terminal portion of the intestinal canal, and its relation to the parts around, cannot be predicted with any certainty; since, in the two first classes of cases of imperforate anus, or of anus opening into a cul-de-sac, the intestinal canal may terminate in a blind pouch at the brim of the pelvis, the rectum being wholly wanting; or, as in the third class, an imperfect rectum may form and show itself as a short sac descending to the floor of the pelvis, or to the neck of the bladder in the male, or commencement of the vagina in the female. An explanation of these different conditions is to be found in the fact that these malformations are clearly due to some failure in the fœtal development,

Fœtal development.

and to the want of junction of the two ends of the rectal tube. The *anal* portion of the bowel, which develops from below, grows upwards, while the *intestinal* descends from above; and these two parts subsequently advance, and, in a natural condition, unite; the membranous diaphragm at the point of their junction, disappearing at a later period, by interstitial absorption. When a failure in this uniting process takes place, the *second* class of congenital imperfection is formed; when the failure occurs at an early period of development, the two ends of the approaching tubes will be far distant, and, when at a later period, they may be in closer contact. The closure of the anal orifice is due to a firm adhesion of the integument.

FIG. 286.



Anal cul-de-sac.

Showing the intestine ending as a cul-de-sac above the anus. Prep. 1882[78], Guy's Hosp. Mus.

Sometimes the blind pouch in which the intestinal canal terminates is connected with the anal integument, or with the anal cul-de-sac, by a cord prolonged from the bowel above, and it

seems possible, from Curling's and MM. Goyrand and Friedberg's observations, that such cases are caused by an obilteration of the bowel, which was originally well formed, from some intra-uterine inflammatory action; instances being on record where the muscular tissue of the intestine was clearly traced into the cord. Where the upper bowel communicates with the urinary or vaginal passages, it is owing to the incomplete separation of the natural cloaca that exists during the development of those parts.

A clear understanding of the way in which these deformities are caused will explain the difficulties that are met with in their treatment.

Treatment where there is an anal cul-de-sac.

TREATMENT.—On the birth of every child, the condition of the different outlets of the body should invariably be examined, and even when the anus appears normal, a digital examination should be made on the second day, if the bowels have failed to act, as many an infant's life has been lost for the want of this attention, and the consequent postponement of surgical relief till too late a period.

When simple.

In the *simplest* cases, when the anus is closed by a thin membrane, and the bulging of the distended rectum indicates its nature, a cautious central incision through the soft parts should at once be made, and a good result is generally obtained, the power of the anus usually being complete. Mr. R. Harrison, of Liverpool, records the case of a child who was born with an imperforate anus, and was successfully operated upon in the anal region *thirty-three days* after birth. ('Lancet,' Feb. 26th, 1876.)

When complicated.

In the *more complicated* cases, where the anus is closed or absent, and *no bulging of the bowel exists*, where the Surgeon has no means of making out the true position of the terminal end of the bowel, a cautious incision may be made over the spot in which the anus ought to be found, the finger of the left hand acting as a pilot. The incision may be free as long as it is carried upwards and backwards towards the sacrum, and not forwards towards the urethra or vagina. It must not, however, be made too high. Where there is not sufficient room to carry out this practice, the coccyx may be cut away.

Avoid deep exploration.

When these means fail, all further attempts must be relinquished. To introduce a knife, or a trocar and canula, blindly upwards with the vain hope of puncturing the distended bowel, is a practice to be unhesitatingly condemned. Mr. Curling's figures, too, prove that the perineal exploratory operation, unless undertaken with great care, does more harm than good; though when skilfully performed, it is followed by considerable success.

Treatment where cul-de-sac high up.

In the treatment of the second class of cases, when the rectum terminates above in a cul-de-sac, an exploratory operation may be made as just described, but the uncertainty as to the true position of the bowel renders any operative proceeding hazardous. When the two tubes are in contact, and only separated by their membranous ends, as in the case illustrated (Fig. 286), a good result may be expected, but, when they are far apart, no such success can be anticipated. Mr. Curling in his table gives 31 examples of this class of cases. In 27 an attempt was made to reach the bowel, in 16 with success, while 10 of these subsequently recovered.

Intestine to be drawn down if possible.

When the bowel is opened in any of these cases, and is not far from the anus, the Surgeon should use all fair endeavours to draw down the

intestine to the margin of the external opening, and fasten i
sutures to the skin. He cannot often, however, succeed in acco
ing this, the bowel being rarely found at a less distance than
from the perinæum; but when possible, the advantages of the
are great. Where this cannot be attained, repeated dilatation

Repeated dilatation.

perforated bowel is absolutely essential to maintain its pate
otherwise, like all artificial openings, its subsequent contracti
take place. The introduction of a finger once or twice a
sometimes sufficient for this purpose, and in several cases

Tendency of opening to close.

had under care, where the tendency to contract rapidly was
the introduction of a large sea-tangle tent answered admira
tent being placed in water for a few minutes beforehand, to
swell.

Third variety.

When the anus opens in an abnormal position, as in the
and the anus made by the Surgeon is established, there is a
tendency for the abnormal opening to close, several cases b
record in which this result ensued. Three have occurred in my ow
tice. When success has followed any operative procedure in the
it is important that close attention should be paid to the condi
the bowel for many years, and, indeed, for the whole of life,
there seems reason to believe that the bowel which forms th
cul-de-sac has but little muscular power, and is liable to dilat
fæcal collection, as well as to become paralysed, death under th
cumstances taking place from obstruction. In Fig. 287 this

FIG. 287.



Enormous dilatation of the rectum following obstruction due to the contract
artificial opening made into an imperforate rectum twenty-six years previ

Case.

illustrated. It was taken from William L—, æt. 26, who h
operated upon as an infant for an imperforate rectum. He
June, 1874, from exhaustion and peritonitis following intestinal o
tion, this obstruction being clearly due to the narrowing of the

at the seat of the early operation. At the post-mortem the rectum was found to occupy half the abdominal cavity, and was thirteen inches long and eleven in circumference. Its walls were three times as thick as natural, more particularly the peritoneal coat.

When the exploratory ano-perinæal operation has failed to give relief, or when it is inexpedient to make the attempt from the very backward position of the genital organ, other measures must be adopted, and of these the opening of the large intestine through the abdominal wall is certainly the best. M. Rochard, in the 'Mémoires de l'Académie Impériale de Médecine,' 1859, gives ten authentic successful cases of Littre's operation in the groin for this affection. Holmes informs us, in his admirable work 'On the Surgical Diseases of Children,' that he had not met with the account of any permanently successful operation since the publication of Rochard's paper. Guersant opened the colon in the groin eleven times in succession, and once in the loin, without saving a patient. Giraldès, however, had one case in which a child lived two months and a half, and then died from another cause. Operation through the abdominal walls.

The operation, to be successful, must be undertaken early, before the infant is exhausted and peritonitis has set in. Delay is only justifiable when the bowel is not distended and the symptoms not in any way urgent. Inguinal operation.

With respect to the form of operation, that known as Littre's is probably the best, viz. opening the bowel in the groin. The left groin is usually selected, Giraldès having shown from dissection, that in thirty infants operated on for imperforation, the intestine was found on the left in all. ('Nouveau Dict. de Méd. et de Chirurg. pratiques,' 1864.) Huguier has, however, recommended the right, on account of the frequent bend in the colon towards the right groin, and the absence of the rectum in these cases. I have on three occasions performed Huguier's operation with temporary success. In the last case, operated upon in December, 1876, the child (a male) was twelve days old before relief was sought, and he lived eight days, dying from chronic peritonitis, which had evidently existed before the operation. The artificial anus had been made in the lower part of the large intestine, and had the operation been performed at an earlier period good success would probably have been attained. The question of side is, therefore, still *sub judice*. Amussat's operation in the loin is rightly put aside in these cases, on account of the natural looseness of the colon at this part in children, and the very usual oblique turn of the colon after its splenic flexure. Figures likewise favour this conclusion, since out of fourteen instances in which Littre's operation was performed nine recovered, whereas two only out of seven recovered after the lumbar operation. Lumbar operation.

The operation itself has been described in page 719 (enterotomy).

In the treatment of the third class of cases, where the rectum opens into the vagina, the Surgeon may lay open the rectum from the position of the natural anus, having previously passed a director into the vaginal orifice of the gut as a guide, drawing down, when possible, the bowel, and fastening it to the integument by sutures, as originally performed with success by Amussat. As a guide to the perinæal incision, a bent probe may be passed into the vaginal orifice of the bowel, and the end turned towards the perinæum, cutting down Treatment where rectum opens into vagina.

carefully upon it. I have done this with success on four occasions, and in all stitched the bowel to the margin of the integument, forming a good anus. In two cases the vaginal orifice subsequently closed. In two, that were operated on several years ago, the patients have good control over their motions, while the vaginal fæcal fistula seems to be contracting, liquid motions alone passing.

In exceptional instances the deformity though persisting seems to cause no inconvenience. Ricord has recorded one ('Gaz. des Hôp.,' 1863), in which the woman was married, and her husband was quite unconscious that anything abnormal about the parts existed. Le Fort has recorded a second, in which the woman was married and had had three children, the malformation having been accidentally discovered in an examination for some suspected disease of the bowel.

"In such cases as these," adds Holmes, "the termination of the rectum in the vagina must be tolerably free, and there must either be an external sphincter, or the internal sphincter must be hypertrophied."

Where the bowel opens into the bladder or urethra.

When the *bowel empties itself into the bladder or urethra* the case is very hopeless, though the prospects of a successful issue are better under the latter than the former conditions. An exploratory operation in the region of the anus may, however, be made with the usual caution, in the hope of reaching the intestine, which when found may be dissected away from its attachments and brought down to its normal position. On the failure of this operation Littre's should be performed. Mr. Curling has related a successful case of Littre's operation in a boy, eight years of age, who had a good anus in the groin, yet suffered from the occasional passage of fæces into the urinary passages.

By way of summary the following conclusions may be given:

1. In all but exceptional cases of imperforate anus, obstructed rectum, or misplaced anus, an exploratory operation in the normal anal position and an attempt to bring the bowel into its right place should be made; success following the attempt in nearly half such cases.

2. Such exploratory operations, however, to be successful, should be undertaken early, and conducted with great caution—the line of puncture or incision being upwards and backwards towards the sacrum.

3. When these means fail, or are inapplicable, the intestine must be opened in the groin (enterotomy), it being still an open question whether the right or left side ought to be selected, though the latter is the usual one.

4. When an artificial anus has been made, its constant dilatation is a necessity.

For further information on this subject refer to Curling's paper, 'Med.-Chir. Trans.' vol. xliii, and French edition of Holmes's 'Surgical Diseases of Children,' by Dr. Larcher. Bodenhamer, Wm., 'On Malformations,' Wood, New York, 1860. Ashton, 'On Rectum,' 3rd ed., 1860. Cripps, 'St. Bartholomew's Hosp. Reports,' 1882.

Injuries of the rectum.

Injuries of the Rectum.

The anal orifice and lower part of the rectum may be wounded by accident from falls or by design, and, when this occurs, hæmorrhage is a common result. Repair, however, rapidly goes on in these regions, and with the arrest of bleeding by either securing the divided artery or pressure, and some simple dressing, a good result may be anticipated.

In 1876, a severe example of this kind came under my care at Guy's Hospital, in a boy, æt. 12, who was impaled upon a rail, the iron spike entering the pelvis on the inner side of the right tuberosity of the ischium, perforating the rectum about two inches up, and lacerating the anterior wall of the rectum and base of the bladder. The injury was followed by collapse and attended with hæmorrhage. I saw him directly after the accident, and made a free incision into his bladder as for lithotomy, in order to secure a free passage for the urine, it being clear that the recto-vesical peritoneal pouch was lacerated. Some though not severe peritonitis followed, and fæces passed per anum as well as through the external wound. On the sixteenth day I consequently gave opium to lock up the bowels, with the view of making a splint, as it were, of the fæces, and to keep the rectum and intestinal wound quiet. Success followed the practice, and the wound in the bowel closed. After four days the bowels were opened by a dose of castor oil, and convalescence became established. Example.

In parturition, the rectum is sometimes laid open by a rupture, either alone or with the perinæum, and when this occurs the rent ought to be brought together at once, for if this practice be not adopted a plastic operation subsequently will have to be performed. Cases are also on record in which, during parturition, a child's head passed into the rectum, and was delivered per anum. M. Quème (' Revue de Chirurgie,' 1882) cites seven cases of this kind. Ruptured rectum in parturition. Laceration from act of defæcation.

In the *act of defæcation* small lacerations of the anus are not uncommon, when the motions are very large or hard.

In the milder forms of laceration of this kind, cleanliness and laxatives, as a rule, are sufficient to allow the parts to heal. In some instances the rent does not heal, and the case becomes one of fissured anus or painful ulcer of the rectum, and should be dealt with accordingly. Treatment.

Wounds of the rectum inflicted by the Surgeon, as a rule, heal readily, as is fairly proved by the cases of fistula in ano treated by operation, and the recto-vesical operation for stone. The puncture made in the operation of tapping the bladder per rectum for retention also heals quickly.

It is well to remember that the rectum may be wounded by the passage of a bougie, enema syringe, or the introduction of an O'Beirne's tube. Guy's Museum contains specimens illustrating all these forms of injury, and at St. Bartholomew's there is a specimen of perforation of the rectum by a metallic clyster pipe, through which gruel was injected into the peritoneal cavity.

Rupture of the rectum may occur during a violent effort at defæcation, but there is no evidence to show that such an accident can occur when the bowel is healthy. In the majority of cases in which it has taken place some prolapse of the rectum was present. The rupture is usually in a vertical direction. It is known by the sudden appearance of a mass of small intestine protruding through the anus, following a sharp abdominal pain, the result of an effort at defæcation. Rupture of rectum.

H. Mayo (' Dis. of Rect.,' 1833) relates the case of a lady who, during a violent effort at defæcation, felt something give way, and on the following morning discovered fæces in her vagina. An examination revealed a rent two inches up the bowel large enough to allow the end of the finger to pass from the rectum into the vagina.

Foreign Bodies in the Rectum.

Foreign bodies in the rectum.

These may be introduced from *without*, either from mischief or accident, and trouble may be experienced in their removal, their shape and position influencing the result. More commonly, however, they have been swallowed, and have passed down the canal, becoming caught or impacted in the rectum. They are not unfrequently the cause of anal abscess; bones, pins, bristles, &c., being constantly found in the rectum under these circumstances. Stones, hairs, or husks may likewise form concretions that are foreign bodies. When large foreign bodies have been introduced into the rectum, or concretions or solid masses of fæces become there impacted, an anæsthetic should be given to allow of their removal, care being taken not to injure the walls of the bowel more than can be helped, since cases are on record where the foreign body has passed into the peritoneal cavity. With the patient under the influence of an anæsthetic, the sphincters become so relaxed as to allow of the introduction of large instruments, or even the introduction of the hand to guard the bowel and remove the foreign body. Bottles, pots, cups, corks, rings, pencil cases, bougies, sticks, stones, &c., have been impacted in these regions, and considerable care is needed in their removal to prevent injury. The injection of plenty of warm oil before the attempt greatly facilitates the operation. Lithotomy scoops or forceps are likewise valuable, but the ingenuity of the Surgeon is necessary in every case to apply the best means to carry out the end in view. Linear rectotomy may be performed whenever it is called for, and occasionally the foreign body may have to be removed by "Laparotomy." M. Verneuil related such a case at the Société de Chirurgie, June, 1880. It was that of a man æt. 40, who introduced a piece of wood into his rectum to arrest a dysenteric discharge. A few days later, after the introduction of the hand into the rectum had failed to reach the foreign body a median abdominal incision was made and the foreign body pressed downwards, when it was seized and removed after the rectum had been incised from the anus. The man made a rapid recovery. Dr. Thorndike of Boston, United States, also records a successful case in which a large stone was removed from the peritoneal cavity, after having passed into it through a ruptured rectum ('Rep. of City Hosp..' 1882).

Treatment.

A large collection of such cases with their treatment is given by M. Morand in 'Memoirs of the French Academy of Surgery,' vol. iii., by Ashton in his work 'On the Rectum,' and Poulet in a general treatise on foreign bodies in Surgical Practice, New York, 1880.

On diseases of the anus and rectum.

Diseases of the Anus and Rectum.

Their study neglected.

These have only recently received sufficient attention from the great body of surgeons, and, as a consequence, have been too often allowed to fall into the hands of "quacks;" and, although able and respectable specialists have since rescued this important class of cases from their hands, much remains to be done by the profession as a whole, to bring the diseases of these parts into their right position, that is, into the hands of the general practising body of the profession. Again, in no class of cases are so many mistakes met with, and these almost always arise from a want of proper local examination of the parts. The anus or rectum is either unlooked at or unexamined from some mistaken notions of delicacy, or badly examined from want of knowledge or want

of inclination. But such should not be, and every patient who complains of anything like persistent symptoms in those regions should be as carefully examined as he or she would be were any other locality equally affected. To do this, some nicety is required, and, to help the student the following hints may be acceptable.

Examination of a patient.

Mode of examining the rectum.

The best position is on the side with the legs well drawn up and thighs flexed upon the abdomen, the hips being brought to the edge of the bed or couch in a good light; the Surgeon, with one hand having uncovered the parts sufficiently to expose them, may then raise the upper buttock, and in doing this the anus comes well into view; in operations this may be done by an assistant. When an abscess exists, it will then be seen; if a fistula be present, its external orifice will be apparent. Fissures, warts, condylomata, or fleshy, flattened, cutaneous vegetations, or cancerous tubercles, will also be at once recognised.

Loose folds of skin.

Pendulous loose folds of skin about the anus will suggest the former existence of external hæmorrhoids; blue, turgid, venous projections their present existence. A tightly contracted and rigidly drawn up anus, as a rule, means some painful ulcer of the part, and a patulous anus through which flatus or discharge passes without the patient's wish, too often indicates extensive rectal ulceration or stricture.

Internal piles.

Internal piles when prolapsed will appear as turgid, vascular, mucous projections, covered with mucus or blood, surrounded by everted integument more or less œdematous; *prolapsus* recti, as a greater or less annular projection of smooth or rugous mucous membrane, with a central intestinal orifice. A *polypus* projecting will appear as a cherry, surrounded by healthy structures. All these points are taken in at a glance, and understood. A digital examination should then be employed to confirm or refute the suggestions thus taken in by the eye. To do this well, the index finger must be thoroughly anointed with lard or ointment, it being a good plan previously to fill the nail with a piece of soap. It should then be applied to the anus, and the patient told to bear down, as in doing this the sphincter is relaxed. The Surgeon can then with ease, and without pain, introduce his finger. When an ulcer exists at the anus, pain will be caused by, and spasmodic resistance offered to, the introduction of the finger, and, with the pulp of the finger slowly moved round the anus, the ulcer will probably be felt. It should be stated, however, that in many cases, this ulcer will be seen by a careful drawing down of the skin of the anus till the margin of the mucous membrane becomes visible. A spongy nodular feel of the mucous membrane just within the sphincter will suggest internal hæmorrhoids; a local, tender, and raw surface, the probability of a simple ulcer; a circular, indurated raw surface that of a syphilitic sore, while a cancerous ulcer is known by an infiltrated nodular and thickened surface. A stricture within two inches of the anus can always be detected by its annular form or the obstruction which it causes. When a healthy piece of bowel separates the anus from the stricture or ulceration, the probability of the disease being cancerous is rendered great. When no such healthy tissue exists, syphilitic disease is rendered probable. A digital examination will always detect the presence of scybala or impacted fæces, and also the encroachment of uterine or pelvic tumours in women, and prostatic tumours in men. To confirm these opinions thus formed, a speculum

For ulcer in the rectum.

Stricture of rectum.

Cancerous disease.

Use of speculum.

may be used, which should be introduced well warmed and greased in the same way as the finger. Mr. Curling says, "when the mischief is high up in the rectum let the patient stand on the left leg, with the right thigh and leg bent, the foot resting on a chair. Tell the patient to strain. This action will then force the parts down." I have found this method of examination serviceable.

Mr. Allingham "advises the prone position, with the hips well elevated upon hard pillows, to such an inclination that the intestines will gravitate towards the diaphragm, so that when expiration takes place the rectum becomes patulous, and you can see as far as the sigmoid flexure perfectly distinctly." This mode of examination, he informs us, was suggested by Dr. Marion Sims. ('On Diseases of the Rectum,' 1882.)

The speculum represented in fig. 288, as made for me by Krohne, is the one I prefer.

Introduction of hand into rectum.

The practice of introducing the whole hand into the rectum has been frequently adopted by several good Surgeons, and from my own personal experience I believe it to be of value, more particularly for diagnostic purposes, in cases of suspected disease of the rectum above the brim of the pelvis, in pelvic or abdominal affections. In the female patient, it is more readily performed than in the male. The operation, however, is neither easy nor free from risk, since laceration of the rectum has been recorded. It should be performed with the patient under the influence of an anæsthetic, and with extreme slowness (five minutes may well be spent in passing the sphincter ani); the hand should be well greased and introduced with a screwing motion. When the hand has passed within the rectum, much care is required, and, when the narrowness of the gut forbids easy advance no force should be employed, for by force the peritoneal covering of the bowel has been ruptured. With the hand in the rectum the parts above the brim of the pelvis may be readily examined; indeed, the kidneys have been felt, and pulsation in the larger branches of the abdominal aorta can be traced, and consequently controlled.

With these brief general remarks, I now proceed to treat of the special affections.

Fissure and painful Ulcer of the Anus.

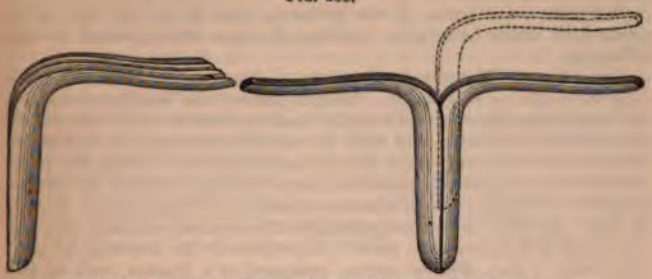
On fissure and painful ulcer of anus.

This most distressing affection produces more misery than any other local disease with which I am acquainted, and renders the natural act of defæcation an agonising one, often "causing great drops of perspiration to course down the temples." It is usually caused by the mechanical splitting of the orifice of the anus from the passage of a large or indurated motion, at the junction of the mucous membrane of the bowel with the skin, although it is not always traceable to such a cause. In some instances it seems to owe its origin to scratching the parts when highly irritable. It is usually a disease of adult life, and common to both sexes; though it has been found in children, even so young as a year and a half. ('Brit. Med. Journ.,' June 6th, 1874.) It is met with as often in the healthy as in the feeble subject, but where it has been allowed to go on uncontrolled it soon tells upon the strongest patient. Constipation, high feeding, sedentary habits, and want of local cleanliness, are the common causes, but anything that sets up irritation in the intestines is likely to produce it, and, when once started, unless treated with discrimination, it

Effects produced by the local disease.

may go on for years; indeed, it is by no means unusual to hear that the symptoms have been endured for two, four, or even six years. It gene- Symptoms.

Fig. 288.



A nest of three. Rectal speculum. Two adapted for use.

rally manifests its presence by some local uneasiness in the act of defæcation, this uneasiness passing on to more or less severe pain. This pain, as a rule, is experienced during the passage of the motion, but in some instances it comes on after the lapse of a few minutes, or even an hour or more after the act, and may last a few minutes or hours. When it passes away the patient is easy till the same cause excites the same symptoms. The motions will often be streaked with a line of pus or blood and diminished in size, sometimes being flattened, at others pipe-like, and this diminution is produced by the spasm of the sphincter, the size of a motion being, in disease as in health, greatly determined by the condition of the sphincter.

On examining the anus the first fact that strikes the observant eye Local signs. is the unnatural resistance the patient makes on separating the buttocks; and, on doing this, the powerful contraction of the sphincter that will be visible. On attempting to introduce the finger, considerable resistance will be encountered, and the greatest pain caused if the Surgeon persevere in his attempt.

The symptoms and local signs of the affection are indeed so characteristic, that the true nature of the case can, as a rule, be diagnosed without the aid of a digital *internal* examination; and a careful *external* External examination will often reveal the presence of an ulcer on the verge of or examination. within the sphincter; when within, the outer border only will be visible. The ulcer is usually, though not invariably, placed at the posterior Situation and margin of the anus, and is rarely larger than a sixpence, if so large. size of ulcer. When recent it will be soft, with slightly elevated edges; and when of long standing, indurated with an irregular surface, small polypoid growths fringing its border. The ulcers are at times multiple, in exceptional cases involving the bowel higher up. It is an affection of the mucous and submucous tissue, and painful only from its position, besides being obstinate in healing, from its connection with the sphincter ani. Simple fissures of the anus rarely involve other than the mucous membrane and skin around the parts, and are often associated with piles, though occasionally with small polypi. Ulcers are often hidden from view when piles or folds of skin exist about the anus, but pain indicates their presence.

In women this affliction is so often associated with reflective uterine symptoms as to be frequently overlooked, and in men urinary irritation may mask the disease.

Reflected nerve pains.

Reflected nerve pains in the perineum and down the leg, as in sciatica, or in the loins, as in lumbago, &c., are often induced by the affection.

Treatment in simple fissures.

TREATMENT.—Happily for patients, the treatment of this disease is as successful as it is simple. *Simple fissures* are readily treated by the administration of a laxative, the local application of the nitrate of silver or of lead lotion mixed with the extract of opium, and local cleanliness, with simple, nutritious, and unstimulating diet. When the parts are indolent, or syphilis is suspected, black wash may be used, or calomel dusted over the part, or applied as an ointment, of five grains to a drachm of lard. In other cases the application of mercurial ointment with the extract of belladonna gives relief. Injections of the decoction of rhatany twice a day, or of an enema composed of a drachm each of the extract and tincture of rhatany in five ounces of water are sometimes of great use, as also is an ointment ten grains of iodoform to the ounce.

In ulcerations.

When a larger *ulcer exists*, and is quite recent, the same treatment may be employed; but when the ulcer has existed for any time, and has a hard base, it is quite exceptional for a cure to take place by these means, the Surgeon being hardly justified in making the attempt, when he has at hand such an efficient means as *the division of the base of the ulcer with the superficial fibres of the external sphincter*. This can be done in many cases by the introduction of the finger with a probe-pointed bistoury pressed flat upon it, and introducing them to the upper margin of the ulcer, and then turning the edge of the knife towards the surface of the ulcer, and incising it. Boyer, who first suggested the principle of treatment, advised the free division of the sphincter, but Copland and Brodie introduced the minor operation, which in the bulk of cases is sufficient to effect a cure. In very chronic instances, Boyer's operation may be demanded. When an anæsthetic is given, a speculum may be used, and the ulcer, being exposed, should be divided by a sharp bistoury, transfixing the tissues at the base of the ulcer on cutting inwards. The essential point of practice to observe is, the free division of the base of the ulcer down to healthy tissue, the mode of doing it being unimportant. When any fold of skin or pile exists near the ulcer, it should be removed. The *forcible dilatation* of the sphincter, and its laceration with the thumbs in the rectum, as practised abroad, is a barbarous treatment compared with the above, though when a patient is under an anæsthetic it may be followed.

Division of the ulcer and fibres of sphincter.

Mode of performing.

Forcible dilatation.

After-treatment.

Mistura Olei.

In the after-treatment, the bowels must be kept slightly loose, and for this purpose nothing equals in value a mixture of one ounce of olive oil, rubbed down with forty-five grains of carbonate of potash, and mixed with seven ounces of peppermint or chloroform water, one ounce being given two or three times a day to produce a soft evacuation. Indeed, before as well as after the operation, this mixture should be employed; when it fails, enemata ought to be used. The diet should be simple, and rest maintained till the cure is complete, for where this rule has not been observed, I have known the ulcer become so indolent as to require a second division, which, under other circumstances, is

rarely required. Tonics are often of value during the convalescing period.

Spasm of sphincter.

Spasm of the sphincter is not a disease, but a symptom, caused by reflected irritation from some rectal, uterine, or other local affection. It may be a small or superficial ulcer beyond the verge of the anus, the presence of worms, the existence of a small polypus, or some other local cause of irritation of the mucous membrane lining the bowel, will be found after careful investigation.

Neuralgia of rectum.

The same remarks are also applicable to *neuralgia of the rectum*, though it is quite reasonable to believe that a pure neuralgia may occur of this part as of any other. Yet, as a rule, it is caused by reflected irritation from some nerve with which the part is connected, and the Surgeon should clinically so regard it. It is said to be common in gouty subjects, and can certainly be relieved by free purgation. At times it is caused by malaria, and cured by large doses of quinine.

Anal Abscess and Fistula in Recto.

Anal abscess and fistula in recto, considered together.

The two subjects of anal abscess and fistula in recto are classed together, as the latter disease is almost always preceded by the former, though a large number of cases of anal abscess recover without passing into a fistula. Of my notes of 236 consecutive cases of the two diseases, 43 commenced and ended as anal abscess, while the remaining 193 were treated as fistula in recto; 74 of these cases were females, and 162 males, men being evidently more liable than women to this affection. It rarely occurs in children, though I have successfully treated a case in a male child four months old, and a second in one of fifteen months; in the latter the fœtor of the discharge was very great.

Causes.

Of the causes of this disease, little positive information can be given, because, as a rule, the abscess is obscure in its origin, slow in its progress and repair; some patients even professing to have been unconscious of its existence till it was about to burst. In other cases, however, they are very *acute* in their action, and very painful.

Not always dependent on ulceration.

That an anal abscess must always result from some ulceration of the bowel within the sphincter is an opinion which can scarcely be regarded as true, there being no evidence to support such a view, and the fact that so many as forty-three out of 236 cases of anal abscess recovered without forming a fistula, goes far to prove its error. It is not unfair, therefore, to infer that, in many cases, it depends upon a different cause.

Fistula generally follows abscess.

In fistula in recto this argument must be equally strong, since it is generally believed that this affection is merely the sequel of the anal abscess; we must, consequently, look for some other and more general cause than that ordinarily received, namely, perforation of the bowel from ulceration.

Mechanical irritation a cause.

The mechanical irritation of a foreign body is doubtless an occasional cause, it being by no means uncommon for a Surgeon to remove from the anus, when opening an abscess, a piece of fish-bone, bristle, or other foreign body. Quite recently I removed a pin.

May occur at any period of life.

These affections may occur at any period of life, though I have seen a fistula in a child four months old, and, in the majority of instances, it is found in adults between twenty and forty years of age. Dr. Lipscomb, of St. Albans, related a case to me which took place in

his practice that was congenital, the mother having conceived when worrying about her husband, who was suffering from fistula. It is very common to be informed that the fistula had existed for several years before surgical aid is sought.

Connection between phthisis and fistula.

With respect to the connection between phthisis and fistula it is difficult to give any positive information. During the eight years that I was registrar at Guy's, I inquired carefully into this point in every case, but had only 3 out of 193 in which either hæmoptysis or other symptom of marked phthisis were present. In the majority of cases, the patients presented no more severe cachectic symptoms than is usually met with in other hospital patients, and I confess to being somewhat doubtful as to the fact, that fistula in recto is a common consequence of phthisical disease. When, however, fistula and phthisis are associated, the former is usually of a bad form.

Varieties. Complete. Blind external. Blind internal.

When a fistula has two openings, one externally and the other into the bowel, it is called *complete*. When there is an external but no internal opening to be found, it is known as the *blind external*. When an internal but no external, *blind internal*.

That as a rule an internal opening exists is now scarcely doubted, although at times there may be great difficulty in finding it. M. Ribes, in 1819, examined the bodies of seventy-five people who died with fistula, and in all he found an internal opening; in nearly all, this was placed just within the sphincter, but in no instance was it higher than half an inch. Modern Surgeons now accept these facts. The pus that forms in these parts is very offensive at times, as often from the absorption of fœtid gases through the mucous membrane as from the mixture of fæculent matter. In a large number of cases, the discharge has no fæcal odour.

Fistula may accompany other diseases.

It should always be remembered that an anal fistula may accompany severe rectal disease, such as stricture or ulceration, or that it may be connected with disease of the pelvic bones, &c. In the case of an old man with an enormous abscess between the base of the bladder and the rectum, constitutional symptoms were very severe till two deep incisions were made on either side of the perinæum, giving exit to a quantity of pus, when an excellent recovery ensued. In this instance it was a question whether the prostate gland was in fault, but no other symptoms of such a complication could be ascertained.

Treatment of anal abscess

TREATMENT.—In cases of anal abscess *free incision* is the best practice, which should be made as soon as fluctuation can be felt externally or through the bowel. Deep-seated abscesses in these regions should not be left to natural processes to open. When the abscess is in front of the anus and rectum, an early opening may be called for on account of the retention of urine, to which it may give rise. The incision should be made from without inwards, in a line radiating towards the anus. In deep-seated abscesses, one or two fingers may be inserted well into the rectum, and the abscess pressed forwards before the incision is made, a sharp straight bistoury being the best instrument to use. A piece of oiled lint should be inserted into the wound, and kept there for a day.

When deep seated.

Consequence of not making early opening.

In a case I saw in 1872, owing to the neglect of making an early opening, emphysema and phlegmonous inflammation of the perinæum, scrotum, penis, and abdomen even up to the axilla took place, a free communication evidently existing between the bowel and the abscess.

The patient died from the constitutional irritation of the disease. The sloughing of the cellular tissue was very extensive and the fœtor of the sloughs was something to remember.

After the abscess has been opened, the patient should be kept at rest in the horizontal posture, some antiseptic dressing applied to the wound, and the most perfect cleanliness observed, laxatives being given when the motions are hard, and also tonics to improve the health.

Treatment of fistula in ano.

When a *fistula exists*, the best operation is its division into the bowel, the action of the sphincter ani having, doubtless, a powerful influence in retarding repair. The bowels should previously be cleared by a mild purge two days before the operation, and an enema given on the morning of its performance. The patient should be placed on the side upon which the fistula exists, with the legs well drawn up, and brought to the edge of the bed or couch. An assistant should separate the buttocks. The Surgeon ought then to introduce a fine probe-pointed grooved director into one of the fistulous openings, and, with the greatest gentleness, guide it through the fistula. Anything like force will excite resistance on the part of the sphincter to its introduction and cause pain. When the end of the probe passes into the bowel through the internal opening, all that is required has been effected, and if difficulty be experienced in doing this, the well-greased index finger of the opposite hand can be carefully inserted into the rectum and the internal opening felt for, through which, when found, the end of the probe can readily be guided into the bowel. When no internal opening exists (a rare condition), the director must be forced through the bowel at the upper part of the sinus.

Operation of dividing a fistula.

As soon as the director is felt in the rectum, the patient should be told to strain, the Surgeon, at the same time, with his index finger hooking its end downwards. By these means the director will be made to protrude from the anus, when the whole of the tissues bridged over can be readily divided (Fig. 289).

When the fistula runs high up and much force is called for to turn the probe out of the anus, it is better to pass a speculum and to divide the fistula.

When a long sinus runs up by the side of the bowel, it should be laid open through a speculum, to leave it alone not being a safe practice—for, although in some cases a cure may take place, in many the discharge into the rectum will continue

When there is a long sinus.

Fig. 289.



Grooved probe passed through anal fistula before its division.

Character and conditions.

deed, that bleeding is often the first symptom that attracts notice. inquiry, however, it may generally be made out that constipation been the normal condition, and that irritation about the anus, wit feeling of heat and fulness in the parts, had previously existed. Th

Fig. 290.



Internal hæmorrhoids.

piles often appear after parturition. When the parts *inflame*, there be throbbing, and pain in defæcation; when they *protrude*, there be one, two, three, or more masses of thickened mucous membrane nævoid structure, presenting either a smooth and tense, or a reticul surface. Sometimes there will be oozing of blood from the whole face, or the blood may spurt from a distinct orifice. The bloo almost always red and arterial, and the mucous projection is surrou by skin, more or less pendulous, œdematous, or infiltrated with inf matory products (Fig. 290).

When the parts are not inflamed this hæmorrhoidal mass may trude only during defæcation, and return naturally, or after a pressure. When the disease has been of long duration the pile protrude on the slightest exertion, even on the patient assuming erect posture, or on coughing; the whole mucous membrane of rectum often participating in the prolapse, and adding to the comfort.

Pain attending them.

The *pain* attending the development of these piles varies va small hæmorrhoids often giving rise to severe local distress, the larger cause but little. An inflamed pile is, however, al painful, and a prolapsed inflamed one the most of all. Where is excessive, and more particularly felt after defæcation, there strong probability that a *fissure or ulcer* complicates the case.

Hæmorrhage as a symptom.

The amount of *hæmorrhage* bears no proportion to the extent of disease. In one of the worst cases of hæmorrhage I ever saw, in w a lady was blanched and almost pulseless, the pile was not larger half a nut; it was of the reticulated kind, and the blood spurted from a vessel as large as the radial artery. On the removal of the a complete recovery ensued. On the other hand, it is remarkabl

what an extent the local disease may develop in some cases without producing excessive bleeding.

The bleeding, as a rule, takes place after the action of the bowels, and covers the motion; occasionally it precedes it; but in many instances it is quite independent of all action of the bowels, blood flowing on the patient assuming the erect posture, or at odd times without any such cause.

Loss of blood may be great.

The amount of blood said to have been lost, under these circumstances, is somewhat remarkable, writers upon these subjects relating the loss of "three chamber-potfuls," "eight or nine pounds," &c. Doubtless, in many of these accounts there is exaggeration; still, all Surgeons must, at times, be astonished at the loss of blood that takes place in these cases daily, sometimes for years, but with little apparent interference with the general health.

Mucous discharge.

The discharge of a thick mucus from the anus is a frequent accompaniment of this affection, and when *ulceration* complicates the case the secretion is of a muco-purulent character.

Urinary irritation.

Urinary irritation, and at times *retention*, in both male and female subjects, and in women *womb* complications often add to the distress.

Nerve pains.

Nerve pains passing upwards to the loins, hips, and round the sacrum, or even downwards to the heel and sole of the foot, are likewise met with. Brodie gives a case in which the heel pain was the most prominent feature.

Dyspepsia.

What are called dyspeptic symptoms are almost always present, the assimilating organs suffering as well as the circulatory and nervous systems.

This affection is usually met with after puberty. In early life, men are probably more liable to it than women, but, after forty-five, both appear equally liable.

Constipation.

Constipation has probably an important influence in causing the disease, and certainly in increasing it, but sedentary occupations and high living appear to have a stronger effect. In the prosperous classes of society this malady is comparatively common, although in the poor, daily hospital experience does not help to confirm the notion that it is rare. Whatever tends to retard the flow of blood from the hæmorrhoidal veins, such as pregnancy and abdominal tumours, aggravates the disease, and whatever tends to keep up irritation in the rectum, such as drastic purgatives, worms, and pungent food, acts in a similar manner.

May simulate polypus.

A pile may be mistaken for a polypus, but the smooth, firm surface and pedunculated form of the latter will reveal its true nature. Again, a ring of piles might be confounded with prolapse of the rectum, but the uniform smooth and generally non-bleeding surface of the latter, with its broad attachments, ought to be enough to prevent the error.

External piles, when ulcerated, may also assume very much the aspect of venereal anal outgrowths, which can be made out only by the history of the case and other clinical symptoms. Finally, it must not be forgotten, that hæmorrhoids may be merely a consequence of another disease, such as stricture of the rectum.

Treatment of piles.

TREATMENT.—All piles do not require removal. In the early period of their growth they may be so successfully treated by what is called

Palliative. *palliative* treatment as to render more active measures unnecessa and, in the very cachectic and diseased, it may not be expedient to more than relieve; although it must be added, that unless org disease exists to threaten life, there are few general conditions patient that forbid the removal of a severe bleeding pile. Again, w piles occur in plethoric subjects, who are, perhaps, what has been scribed as apoplectic or gouty, and an attack of them is preceded constitutional disturbance, and followed by relief, the Surgeon sh be careful in checking suddenly the flow of blood, as such a measu undoubtedly sometimes followed by alarming constitutional sympt though such cases are rare.

Diet. The *palliative* or *general* treatment of piles means attention to d the giving up of high living and strong drinks, beer and spiri particular being avoided, and the taking of simple nutritious foo moderation.

Laxatives. The bowels should be regulated by the *Mistura Olei* already descr (p. 796), or by castor oil, rhubarb and magnesia, or some saline m cine or mineral water, such as Vichy, Friedrichshall, or Pullna, when these fail, by enemata. Indeed, the daily enema of cold w or the use of the rectum plug, through which cold water is allowe flow, is of great value. Violent purgation, more particularly by and colocynth, should be avoided. Some prescribe copaiba, bu nauseous qualities forbid its general use. The confections of s or sulphur are useful, and that of black pepper (Ward's paste) has always popular. A mixture of confection of senna ʒj, confectio sulphur ʒj, powdered guaiacum ʒij, and treacle, is very beneficial. compound liquorice powder is of great use. Dr. Cleland recomm ('Practitioner,' Jan., 1876) the use of the liquor bismuthi ʒij, m with ʒj of starch, as an enema, to be used at night in prolapsus r In piles, both in the child and adult, drachm doses of glycerine, bined with 15 grains of citric acid and some vegetable bitter t times a day, may be administered.

When the secretions of the liver and intestines are unhealth little blue pill or grey powder and chalk at bed-time are sometim use, some bicarbonate of potash in gentian or calumba assisting covery.

Cleanliness. Absolute local cleanliness should always be observed, and the re bent position assumed after defæcation, the prolapsed pile being al

Reduction of piles. reduced at once by gentle pressure. By these different means attack of piles may pass away never to return, or to return only a long interval; but even in the worst cases relief may be given.

Leeches when inflamed. When the piles are inflamed, the application of leeches occasion gives great relief, bleeding being encouraged by hot fomentati such means, however, are rarely called for, the complete washing of the lower bowel, rest, and fomentations being generally suffic In some cases, the application of ice in a cup-sponge gives more r under these circumstances than any other remedy.

When pile sloughs. When the prolapsed internal piles are strangulated by the sphin spasmodically contracting around the mass, sloughing of the whole take place. Under these circumstances, great pain is caused by tension of the parts, and on one occasion I was tempted to cut with scissors some of the projecting portions, when the relief wa marked that I would repeat it under the same circumstances; to ad

this practice with safety, the pile must be in the condition that precedes its death. When this sloughing takes place, a cure may follow. During the sloughing process, a poultice is the best application.

Enemata and astringents.

The mucous discharge from the bowel in long-existing piles can only be met by enemata and the application of astringents, such as an ointment of tannic acid, ten grains to the ounce, of gall and opium, or of extract of rhatany, half a drachm to the ounce of lard or spermaceti. The occasional introduction of a suppository of tannic acid into the rectum is likewise a valuable expedient; and an enema of alum or tannin, five grains to the ounce, is also serviceable. Allingham speaks highly of an ointment of the persulphate of iron, half a drachm to one drachm of the unguentum cetacei, or, as a lotion, twenty grains to an ounce.

Surgical Treatment.

Surgical treatment of piles.

Unless the general condition of the patient forbids, all piles, external or internal, should be removed, when they not only give local annoyance, but by the hæmorrhage produced they disturb the general health of the patient and induce weakness. To accomplish this, many means are at our disposal.

External *hæmorrhoids* ought to be removed by abscission.

Internal piles not to be excised.

Internal piles ought never to be excised, but destroyed by the galvanic or actual cautery, crushing, or the ligature. In the hands of many Surgeons the ligature still holds its ground, but with as many it has been nearly, if not altogether, superseded by crushing or the cautery. I have used the ligature only in exceptional cases for at least twenty years. In a few cases, nitric acid is of service. In Paris, a plan of treatment has been successful, which claims attention, as it receives the support of M. Verneuil. It consists of forced anal dilatations, either by the thumbs of the Surgeon or by means of a dilator, the piles withering after one full dilatation of the anus.—('Union Medicale,' March 6, 1877.)

Ligature, and mode of use.

The Ligature.—The patient having made the hæmorrhoidal tumours protrude by straining over a stool containing hot water, or by an enema of warm water, should be placed on his side, with his legs drawn up and the parts well brought into view by an assistant separating the buttocks. The Surgeon should then grasp the base of the tumour that is to be ligatured by a pair of forceps (Figs. 291, 292), and separate the pile from the skin and submucous tissue by scissors, subsequently transfixing it with a needle armed with a double silk or hempen ligature. He should then divide the cord and tie the pile tightly in halves, cutting off with scissors half at least of the strangulated portion before finally tightening the second ligature; a second or third mass should be similarly treated; the ends of the ligatures should then be cut off, and the whole returned within the sphincter. The Surgeon should be careful to include in his ligature all the diseased tissue, and when this has not been done with the forceps, it is better to pass a needle or tenaculum through the base of the pile higher up, and loop a ligature round it, than to remove the forceps and reapply it. He should also take care not to include any of the external skin.

The ligatures may be expected to separate about the seventh tenth day, and they should always be allowed to slough off.

After-treatment.

After the operation, an opiate may be given, or a full dose of chlo (half a drachm). The bowels should be left undisturbed for at le two days, when a dose of castor oil or other purge may be administer

Fig. 291.



Fig. 292.



or, better still, an enema. The horizontal position must be maintai throughout the case. If œdema of the parts follow, ice may be appl or a lotion of lead and opium; belladonna rubbed down with glyce at times gives relief. Until the bowels act, the diet should be sim nutritious, but not stimulating. This operation is successful, and no special danger, though it is, perhaps, more tedious than the tr ment by cautery.

Use of cautery.

The Cautery.—When internal piles require removal, the clamp cautery are means I generally employ, and the thermo or *galv* cautery is preferable to the *actual*. Cusack, of Dublin, sugge this practice in 1835; but Henry Lee and Henry Smith have d more to establish it than any other Surgeons. It is adopted as follow

With the clamp.

The patient having been prepared as for the ligature and the piles trnded, the anus is to be dilated forcibly with the view of allow free manipulation of the piles, as well as of preventing subseq spasm of the sphincter. Each mass is then to be seized seriatim the vulcellum forceps, drawn down and secured at its base by cla (Fig. 293, a modification of Curling's, being as good as any), the u end of the clamps presenting towards the anus. The projecting of each mass must then be cut off with scissors, the surface wiped and the cautery, heated to a white heat, applied to the surface; whole projecting portion being burned down to the level of the cla a dense eschar is thus formed. When the thermo or galvanic cau cannot be had, the actual cautery must be employed, a second b at hand to use as the first cools.

The eschar is more solid and firm after the thermo or galvanic t after the actual cautery; it is likewise followed by less pain, the

being so intense as to destroy all sensibility. Ample experience with both has convinced me of this fact.

As each mass is destroyed, the clamp should be removed, care being taken not to disturb the eschar. When all have been treated, the whole projecting mass may be returned into the rectum, with the finger well greased, it being a good plan at this moment to introduce a suppository of opium or morphia to soothe pain.

After-treatment.

The patients should be kept at rest for at least two weeks after this operation, but they will often be anxious to go about much sooner, saying that they feel quite well. A fortnight is the average time for convalescence, but a week in good cases seems sufficient. In one of the worst cases of internal piles I ever treated I applied the clamp to four masses and burned them down as described with the galvanic cautery. After the first day all pain had gone; on the fourth the bowels acted naturally without the slightest inconvenience, and in a week the man was up, no single drawback having taken place. Such a case, however, is exceptionally good even for the cautery.

The after-treatment is the same as in ligature, the local application of ice, perhaps, giving greater comfort.

FIG. 293.



Clamp for hæmorrhoids.

Cautery without the clamp.

Ignipuncture.—In not a few examples of internal hæmorrhoids, where one or two sessile masses alone existed, I have, by means of a speculum, without the aid of a clamp, applied the galvanic or thermo cautery to their surfaces direct, and in others I have merely punctured them in 2, 3 or more places, according to their size, taking care to rotate rather than pull on the cautery in its removal. Nothing but good results have followed the practice, and I am disposed to think in such cases it is the best to adopt. Mr. Reeves has recently strongly advocated this method. A good sound eschar forms at once, and, on its removal, a recovery takes place.

Igni-puncture.

Demarquay (' Gaz. de Paris, 1860) merely passed a hot iron over the surface of the pile to produce a superficial eschar. He advised also linear écrasement where the piles only protrude on defæcation and can be replaced, and where the sphincter is not relaxed, nor the mucous membrane of the rectum prolapsed. In all other cases he prefers the cautery.

Treatment by Crushing.—This method was introduced into practice by Mr. G. Pollock (' Lancet,' July 3, 1880), and a clamp suggested by Mr. Benham employed.

Crushing.

The instrument is to be adjusted as in the operation for cautery, and the protruding pile cut off with scissors. The clamp, which is very strong, is left on the pile for one minute. Messrs. Pollock and Allingham have employed this method of crushing very largely, and speak favorably of it. It is said to be safe and to be followed by less pain than other methods. I have followed this practice in only a few cases, but have no reason to prefer it to the cautery.

Treatment by the Subcutaneous Injection of Carbolic Acid.—This method has been employed freely in America, and, apparently, with success. It is applicable to internal piles alone, and one pile should be treated at a time, about a week being allowed between the operations. About one to six drops of a solution of one part of carbolic acid in 30 of olive oil or glycerine should be injected with a hypodermic syringe into the pile, which turns white, and in successful cases, withers without pain or sloughing. An ointment of vaseline should be smeared well over the parts around the pile to guard against any injury from the dropping of the fluid. The majority of cases treated in this way, according to Dr. Andrews, of Chicago, are cured rapidly.

Use of nitric acid.

When **nitric acid** is used, the patient should be prepared and treated in the same way as for the cautery; the acid should be applied with a piece of wood to the diseased surface. The spoon-shaped clamp forceps are probably the best to use under these circumstances. After the application of the acid the parts should be well oiled and returned. This practice was suggested by Dr. Houston, of Dublin, in 1857. To small, flat, strawberry-looking internal hæmorrhoids, this plan of treatment is applicable; but is not so satisfactory as the cautery. I never now employ it. Ulcerating piles may be treated in the same way as others.

When a fissure or painful ulcer co-exists with hæmorrhoids, its base should be divided before the operation for hæmorrhoids is undertaken, or, what is better, lacerated by forcible dilatation of the anus.

Care not to include the skin.

In operating on internal piles the Surgeon must be careful not to take the everted and possibly œdematous skin that encircles the mucous hæmorrhoidal mass for external piles, and remove it. This should on no account be touched. Pendulous external hæmorrhoids can also be taken away at the same time.

Propriety of chloroform.

In rectal operations when an anæsthetic is employed, the patient requires to be brought completely under its influence. It is probably advisable to use anæsthetics in all cases.

Local anæsthesia useless.

Local anæsthesia in these operations is worse than a delusion except for the removal of external piles, but it is of use to assist their reduction when inflamed and œdematous, and to give relief after operation.

Prognosis of the operative measures.

The danger of operating is but small, though fatal cases have followed both the ligature and cautery; the advocates of the latter say it is safer than the former. Mr. Henry Smith had only four deaths in 400 cases operated on by the actual cautery.

Prolapsus Recti.

Prolapsus recti.

This is met with in every degree of severity, from the mere protrusion of a ring of *mucous membrane* through the anus (Fig. 294) to the prolapse of even a foot of *entire bowel*. In children a mild form is very common; it is usually a symptom either of some urinary irritation, such as a stone, or of a long or adherent prepuce, worms, constipation, dysentery, a *polypus*, or any rectal irritation may likewise induce it, as may a cough in very feeble subjects when the sphincter has lost its tone. One of the worst cases I have seen in an adult was due to the existence of a villous polypus, high

up the rectum; the straining accompanying the affection and the hæmorrhage was very severe, but a rapid recovery ensued on the removal of the growth. In another case, that of a lady, where the bowel had come down for sixteen years accompanied with daily hæmorrhage, and in which walking was rendered impossible from the extent of prolapse (about six inches of bowel) the removal of the mucous membrane in three portions by clamp and cautery rapidly effected a cure.

To ascertain the true cause of the affection, consequently, is the first aim of the Surgeon, the treatment being then comparatively simple. On its removal the prolapse rapidly disappears.

Fig. 294.



Prolapsus recti.

Treatment of prolapsed bowel.

Reduction.

Treatment.—Whenever the bowel comes down it should be returned, and this can usually be effected by placing the patient in the recumbent posture and pressing with oiled fingers flat upon the part. In children, the utmost gentleness should be employed, for with pain resistance is produced, and with it increased difficulty in reduction. Under all circumstances the patient should be kept in the recumbent posture. The bowels should in children be relieved lying down, and in adults, the horizontal posture ought always to be assumed after natural relief. Brodie advised nocturnal relief of the bowels to be encouraged with this object. When the parts have been down for some time, the greatest trouble is often experienced in their reduction, indeed, sometimes it is impossible; although, with the patient anæsthetised, success may attend the gentlest efforts when forcible attempts had previously failed. When the bowel has been reduced, a good pad or sponge fastened on with a T bandage will keep it in place, or the nates may be fastened together with some good bands of strapping. When the bowel is inflamed or ulcerated—conditions that soon occur in chronic cases when the patient goes about—some slight scarification may be called for; but the application of cold in the form of ice is probably the best treatment. In obstinate cases in children, the free application of the nitrate of silver in stick to the whole mucous surface, previously wiped with lint and subsequently mopped, is often followed by its reduction and retention. I have never seen this practice do harm; and one application has often cured the disease. The injection of three or four ounces of water made astringent with tannic acid, in the proportion of three grains to the ounce; or, with tincture of iron, ten drops to the ounce; or of the infusion of krameria, or decoction of oak bark, with or without alum, after the bowels have been relieved, is a valuable adjunct; in adults the tannic acid suppository twice a day is useful, as also the application of the tannic acid glycerine before its reduction. A

Scarificatio

Nitrate of silver.

Astringents.

mixture of the solution of the perchloride of iron with two of glyc
likewise a good application. Costiveness should never be allowed,
enemata being used to keep the bowels empty, or the mildest la
as rhubarb, castor oil, or some natural saline water as the Pul
Tonics. Friedrichshall. To give the bowel tone, tonics, as a rule, are re
nux vomica being probably the best, either alone or in comb
with iron. I have never employed this drug in children as the
tonics usually suffice, though some Surgeons speak highly of
Nitric acid. children, as an alterative, rhubarb, soda, and calumba mixtur
be recommended. In more severe cases of prolapse, the applica
Removal of folds. nitric acid in vertical strips is very valuable, or, what is bet
thermo cautery similarly applied. In bad cases, it may be ne
to remove three or four vertical folds of mucous membrane w
clamp and cautery, as for piles. Few operations in surgery ar
successful than this, and although in children it is probably
required, yet in adults it should never be rejected except for th
causes as operations for hæmorrhoids. In very extreme cases of p
the linear cauterisation of the prolapsed bowel may be advanta
employed.

The treatment of such a case would be precisely similar to th
down in the last section for piles.

Polypus of the Rectum.

This is not so rare a disease as authors would lead us to belie
the adult it is so comparatively, but in the child it is *the pr
cause of hæmorrhage from the bowel*, and from this fact
of polypus have been doubtless put down as those of piles.
growths are generally found in children under ten years
Polypus of the rectum. More frequent in children. and in male more commonly than in female subjects, sin
of eighteen consecutive cases fourteen were in males, thir
children under ten, and five in adults. These growths vary
from that of a pea to a large cherry, they grow from the sub
tissue, and are covered by mucous membrane. When far
the reach of the sphincter and small, they probably do no
any inconvenience, though when large, they may give rise to st
of the bowel, prolapsus recti, and even intussusception. One
worst examples of prolapsus recti I have ever been called
Size. treat, was due to the presence of a fibrous polypus situate
inches up the bowel of a man 50 years of age, who had suffere
it for twenty years. He was cured by the removal of the
Mr. Pollock ('Holmes' Syst.,' vol. iv, ed. 2) has given a case i
intussusception took place, and in a case of my own th
Attended with bleeding. result ensued. As they near the sphincter, local irritati
hæmorrhage are produced, the growth appearing often at the
a pink or red cherry. Blood sometimes flows from the an
during defæcation, at other times quite independently of it.
the polypus is low down, there is usually with the blood
discharge of mucus.

Mode of examination. Whenever a child is brought with these symptoms, a local e
tion should be made, and to do this efficiently the Surgeon shoul
his finger well into the rectum completely round the walls
bowel. By doing this the polypus will be dragged from its

ment, and its pedicle made tense. Sometimes several polypi exist together. I have on one occasion removed three. They are made up of fibro-cellular tissue, being more or less fibrous, according to the age of the patient; in the adult, the fibrous element predominates. Structure.

When a polypus has been discovered, its removal is the only correct practice. In children, when I detect them with the finger, I generally manage to hook them down, and in so doing, break them off. I have never seen any bleeding follow this measure. On several occasions, when I have brought the growth external to the sphincter, the action of the muscle has broken it away, and in this manner many cases of polypi are doubtless naturally cured. When they do not break off, a ligature may be applied to the pedicle, and the growth cut off beyond the knot. In adults, the ligature should always be employed. To be removed by ligature.

On the removal of the disease the symptoms disappear, but when they continue, a second polypus will generally be found.

Papillary or villous growths are occasionally met with in the rectum, as in other parts of the large intestine, and when low down they give rise to violent straining and hæmorrhage. This straining may, indeed, give rise to an intussusception of the bowel, or to prolapsus recti. This was well exemplified in the case of a woman, æt. 43, whom I had under my care in June, 1867. She had suffered from prolapsus recti with more or less bleeding after every motion for twenty years, the straining at times being most distressing. When I saw her, the bowel was down for about nine inches; blood was then passing, and the pain was great. I made a careful examination, but failed to find anything. I reduced the prolapsus, and prescribed rest. On my second visit, with the bowel only down a very little, I examined her again, and with my finger could just touch a new growth. With a pair of long fenestrated forceps I took hold of it and brought it down, finding a splendid specimen of the villous polypus. I put a ligature round its base at once, and cut off the growth. No single unfavorable symptom subsequently appeared; all her former troubles at once vanished, and a complete recovery ensued. In June, 1870, this woman was still well. The growth is illustrated in Fig. 295, with its microscopical appearances (Fig. 296). Villous growths in rectum. Example.

Fig. 295.



Villous polypus of rectum.

Condylomata are also very common about the anus, and are mostly, but not always, syphilitic, the irritation of dirt being probably sufficient to produce them. In children they seem to come from the irritation of worms. Condylomata.

Cleanliness, the application of nitrate of silver, and the dusting of their surfaces with calomel or oxide of zinc, generally produce a rapid Treatment.

cure. *Vegetations* due to the irritation of acrid discharges, s
gonorrhœa or *syphilis*, require to be excised.

Fig. 296.



Fig. 296.—
section of
through the li
295, showing
simple and c
villi, covered
columnar ep
large vessels
base on wh
villi rest;
tions of the
of Lieberkü
section repre
the thickne
lobule of t
pus seen by
power.

Dr. Moxon's Report on Villous Growth, with drawings.

Warty growths.

Warty growths are also met with about the anus, as on othe
neous surfaces. Sometimes they grow to a great extent, a
require excision. I have removed a mass the size of a fist.

Pruritus ani.

Pruritus ani should generally be looked upon as a symptom
rectal or intestinal irritation, constipation, or rectal disease.
always a source of great distress, the most distressing bein
in which the symptoms occur at night in bed preventing slee
best application I know for its relief is a cold sponge, and,
dried the parts, the ointment made of equal parts of zinc, ni
mercury, and subacetate of lead ointments. Zinc and opium o
is also beneficial. The application of cold through the rect
may also be recommended. These remedies, however, only rel
symptom; in order to cure it, the cause must be found
removed. If ascarides be the cause, Agnew advises an inje
carbolic acid and olive oil (1 part to 6), and in obstinate
enema of bromide of potash ʒss dissolved in cosmoline ʒiv.
turnal pruritus, iodoform gr. iij or iv as a suppository. Whe
the presence of minute cracks and fissures, a solution of ni
silver, gr. x to xx, in an ounce of spirits of nitre, is good.

Ulceration of rectum.

Ulceration of the Rectum and Stricture.

The painful ulcer of the anus or anal orifice of the rectum h
already noticed, and it remains for us to consider briefly suc
forms of ulceration of the rectum as are met with in practice
may be described as *simple*, *syphilitic*, and *cancerous*. *Simple*
tion is by no means unfrequent, and, when not involving the
gives rise to symptoms which are usually looked upon as dy
The passage of lumpy fæces with blood and muco-purulent di

Non-malignant.

are the chief symptoms. The rapid passage of the intestinal contents through the sigmoid flexure and rectum gives rise to a slight griping pain, but, beyond this, there are few general symptoms. On examining a rectum under these circumstances, a single ulcer will probably be found, but occasionally others. It may be somewhat indurated at its edges, though its base is not so as a whole. It is often circular, and at times surrounding half the rectum. In the case of a boy, æt. 16, under my treatment, the surface of the ulcer was so nodular that I should have suspected its cancerous nature had I met with it in an adult, but in this instance, it had existed for many months, and the granulations had assumed a polypoid nature. It ended in a recovery. These simple ulcers are also likely to perforate the bladder, and to induce recto-vesical fistula. I have had five such cases, and in four colotomy was performed with success, the operation taking away the chief source of distress, viz. the passage of fæces with the urine—prolonging life, and apparently allowing the ulcers to heal. (*Vide* paper by author, 'Clinical Soc.,' 1872.)

Symptoms of ulcer of rectum.

Prone to form fistula.

These cases can be *treated* by general means, such as a careful regulation of the diet, alkaline medicines with tonics, the administration of laxatives, such as the mistura olei, to cause and maintain a soft condition of the fæces, and the daily administration of a small two-ounce enema of starch and opium, or simple oil. The recumbent position should be maintained as much as possible.

Treatment of ulcers.

Under these circumstances, a good recovery generally takes place.

When these ulcers involve the anus, they give rise to the same painful symptoms as the painful ulcer of the anus, and must be treated in a similar way, viz. by division of the superficial fibres of the sphincter.

Syphilitic disease of the rectum is a more common affection, and is met with in both sexes, though more frequently in women than in men, the disease apparently creeping from the vagina to the rectum. Occasionally it is due, doubtless, to direct introduction of the poison. It appears as a more or less extensive ulceration of the lower two inches of the rectum; and, as a rule, involves the anus, as well as passing higher up the rectum. It is a disease of the mucous and submucous tissues, and is indicated in its early stage by a spongy induration of these tissues, and, later, by ulceration and the discharge of a highly irritating, sero-purulent, or sanguineous discharge, and by a patulous anus. The anus itself may also be the seat of the lateral, flattened, fleshy, cutaneous outgrowth, so common in syphilis, or it may be ulcerated. It is generally a disease of young adult life, and associated with some syphilitic history. There is almost always some pain in the act of defæcation, some looseness of the bowels, and discharge of blood, pus, or mucus. Anal or vaginal fistulæ sometimes complicate the case. In neglected cases, where cicatrization has gone on with spreading ulceration, there may be constipation and some stricture; indeed, as a cause of stricture of the rectum, this syphilitic disease is by no means unusual.

Syphilitic disease of rectum.

Symptoms.

Treatment of syphilitic disease of rectum.

Treatment.—Recognising its syphilitic origin, large doses of the iodide of potassium ought to be given, five grains gradually increased to ten or twenty three times a day, in some bitter infusion or bark; but when tonics are indicated, they may be given in combination. The bowels should be kept slightly loose by the daily dose of olive oil or

castor oil, so regulated as not to purge, and the daily employmen
an enema of starch or gruel, with or without oil, to keep the p
clean, and free from the irritation of fæces.

The recumbent posture should likewise be observed, and sin
nutritious, but not bulky, food taken.

Local measures.

Locally, absolute cleanliness is essential. Where contraction e
or is taking place, the daily introduction of a bougie, anointed
some mild mercurial ointment such as the unguentum metallorum,
be used; but for the patient, the daily introduction of a candle,
larly anointed, is preferable, candles being made of all sizes. Not
like mechanical dilatation should be thought of, as it is dangero
the extreme. By these means a cure may be effected, though such
only be complete after the treatment of months. In very neglect
severe cases, a cure is almost hopeless without colotomy. I have
some striking examples under my care illustrating well the advant
of this operation. The recognition of the disease as syphilitic i
main point of importance.

Foreign authors describe *chancroid* disease of the rectum as vene
and not syphilitic; but in this country it is hardly recognised.
may, however, be found amongst the cases described as simple ul
tion.

Cancerous ulceration of rectum.

Cancerous ulceration of the rectum, usually epithelial, somet
villous, rarely carcinomatous, is generally met with two or three i
up the bowel. It occasionally occurs higher up, and beyond the
of the finger in the rectum, and occasionally lower down, neare
anus, or involving it. It is remarkably insidious in its origin, an

Symptoms.

certain in its progress, giving rise at first only to such sympton
are usually put down to constipation, for this symptom is the
prominent feature, while the occasional pain and bearing dow
straining, are looked upon as the result of the constipation.
general way, it is only when some blood or sero-purulent fluid
passed, with or without a motion, that surgical aid is sought, and
under such circumstances that the Surgeon discovers, on maki
local examination, that such a serious disease exists.

The cancerous ulcer can rarely be overlooked, and occurs as an i
rated, nodular, irregular mass. In its early stage the surface
be smooth; in a later irregular, from ulceration; the discharge, w
is generally very offensive, is made up of broken-up tissue, blood
thin pus. The disease involves, as a rule, the whole circumferenc
the bowel; at others, only a part. It is always associated wi
narrowing of the canal, which will go on to cause its complete o
sion. It generally attacks patients past middle life, but it may be f

Case.

in the young. I have seen it in a boy æt. 15, and in September, 1
I attended, with Mr. Turner, of Bermondsey, a girl, æt. 18, who
had insuperable constipation for seven weeks. I opened her
in the *right* loin with great relief, and she was up and about i
weeks. She died ten months after the operation (June, 1872), w
rectum *completely occluded* from cancerous disease, and with secon
tubercles in the pelvic peritoneum. The disease was examined a
Pathological Society by the Committee on Morbid Growths, and
found by Dr. Hilton Fagge and Dr. Goodhart to be of a cance
nature, confined to the peritoneum and ovary, and only le
to stricture of the bowel by a secondary process of contrac

The stricture had an ulcerated surface, but the mucous membrane did not show any cancerous elements ('Trans. Path. Soc.,' 1875).

Treatment of Cancer of rectum.

TREATMENT.—Palliative treatment can alone be thought of, such as the maintenance and improvement of the general health by diet and tonics; the removal of all local causes of irritation by the use of laxatives to render the motions more liquid, and consequently more easy for evacuation; and the relief of pain by the use of enemata of starch and opium, or by morphia suppositories.

In the very early stage of the affection, before ulceration has taken place, the use of bougies may be justifiable and useful, but when ulceration exists they are injurious and dangerous. When the obstruction becomes a symptom of importance, surgical treatment will have to be thought of; but this will be considered under the heading of stricture of the bowel.

Complications of ulceration.

Complications of Ulceration.

All cases of ulceration of the rectum may go on to cause stricture; the cancerous cases to a certainty must, the syphilitic often do, and the simple may when extensive. The two latter cause a *cicatricial* stricture resulting from the contraction of the cicatricial tissue in the mucous and submucous tissue; the first producing a stricture by simple increment. They may also be complicated with deep-seated abscesses and fistula, and with hæmorrhoids. The Surgeon should, therefore, always be careful when treating these affections to examine the rectum minutely, as it is only too common to meet with cases that have been subjected to useless operations for piles and fistula, when these affections were the results of a far more serious disease, such as stricture or ulceration of the rectum.

Stricture as a result.

Abscess and fistula; hæmorrhoids.

Ulceration into bladder.

Again, any of these forms of ulceration may extend into the bladder or urethra. I have had five examples of such cases of vesico-intestinal fistula under my care in males, and one in a female, in all of which the agonies of a foreign body in the bladder were added to those produced by the ulceration, and in the four male cases complete relief was afforded by colotomy. In three of these the ulceration seemed to be of the simple kind. In another the existence of rectal ulceration was first revealed by a sudden rush of urine through the rectum after an attack of retention.

Ulceration into vagina.

I have seen many cases of recto-vaginal fistula as a consequence of syphilitic and cancerous disease.

Stricture of the Rectum.

On stricture of the rectum.

In the majority of cases this is caused by cancerous disease, in many it is the result of an inflammatory process, simple or syphilitic, from the cicatrisation of deep-seated and extensive ulceration; in others, it is due to the contraction of inflammatory material poured out in the submucous tissue; in exceptional instances, it may arise from contraction of the parts external to the bowel after pelvic cellulitis, and Curling quotes a case where it was the direct result of an injury.

Causes.

Condition of parts in cases of stricture.

In all these conditions the calibre of the intestine is gradually or rapidly encroached upon, till at last complete obstruction takes place. The stricture may appear after death as an *annular* contraction of the bowel with adventitious material in the submucous tissue and hyper-

trophy of the muscular coat, looking very like a so-called scirrhous pylorus; or as a thickened, ulcerated, irregular mass of cancerous material infiltrating all the tissues of the bowel, although rarely extending beyond two or three inches in length. The bowel above the stricture will always be dilated, at times even to rupturing, ulceration of the colon being a very common consequence of the dilatation. Below the stricture there will often be found pedunculated, fleshy, or cancerous growths. These points are well seen in Fig. 297.

It has been already pointed out that fistula, ischio-rectal, vesical, or vaginal, abscesses, and hæmorrhoids, are common accompaniments of stricture.

Statistics

FIG. 297.



Stricture of rectum. $\frac{325^{50}}{}$, Guy's Hosp. Mus.

The disease, taken as a whole, is twice as common in women as in men, and I found from my own notes that thirty-two out of forty-eight consecutive cases were of the former sex. But syphilitic stricture is more common in the female, and cancerous in the male. Curling, in quoting 67 cases of cancer, gives 44 in males. In my 48 cases 20 were found in subjects under thirty, 15 of these being women, and mostly, if not all, syphilitic; 22 were in subjects over forty, half being men, the majority of these being probably cancerous.

Curling's statistics.

The approach of the disease is very insidious, whatever may be its origin or nature, and the symptoms are generally such as have been given under the heading of cancerous ulceration of the bowel.

Symptoms of stricture.

Constipation.

Constipation is the one early symptom, and it is not till some ulceration has commenced, either at the stricture or above it, that others appear. Of these the most common are *diarrhœa*, with lumpy stools, containing blood, pus, or mucus; *straining* at stool, and a *sensation of burning* in the part afterwards; at last a complete stoppage, abdominal distension, and dyspeptic symptoms.

Local examination.

An examination with the finger carefully introduced into the rectum will, as a rule, at once reveal the true nature of the case, for about two inches up the bowel the narrowing will usually be felt with or without ulceration, or the infiltration of the part with new tissue, sometimes the stricture is beyond the reach of the finger, and then probably by pressure upon the abdomen above the pelvis with the free hand, or by the introduction of the hand into the rectum, the disease may be felt.

When the stricture is *annular* it is probably cicatricial or fibrous, possibly cancerous.

When *epithelial* or positively cancerous, it will be infiltrated with a nodular, irregular mass of new tissue, which may be breaking down and ulcerating, and occasionally the mass can be felt externally at the brim of the pelvis over the left iliac fossa.

When *syphilitic*, the ulceration will probably extend upwards from the anus, and such anal integumental outgrowths as have been already mentioned will exist.

In ordinary cases of cancerous stricture there is an inch of healthy rectum between the stricture and the anus, though in exceptional instances and where disease is extensive the anus is involved.

In advanced cases, the anus will appear patulous, and, on separating the buttocks, a red, brick-dust coloured, fæculent discharge may run out; wind will also pass without effort.

Flat tape-like fæces.

To the flat, tape-like, or figured fæces which some authors regard as being characteristic of this disease, I concur with Curling, in not ascribing much importance, since such a condition of motion is not uncommon even in a state of health, when the bowels are irritable; besides many other conditions of the pelvic parts may give rise to the same thing. When a patient never passes a well-formed motion, large or small, the case looks suspicious; and when on the other hand, a large well-formed stool is occasionally seen, the probabilities of a stricture existing are very slight.

Caution in use of speculum.

The examination of a diseased rectum with a tube, flexible or otherwise, with or without injection, requires the greatest care and gentleness, as the gut is easily perforated or ruptured; moreover, the Surgeon may be misled to suspect obstruction where none exists, by the end of the instrument striking against the sacrum, or being caught in a fold of mucous membrane.

Symptoms of stricture may be due to presence of tumour.

It must also be remembered, in examining a rectum for a supposed stricture, that its calibre may be more or less completely encroached upon by pelvic tumours, uterine, ovarian, prostatic, hydatid, or bony. Some few years ago I had a case with Dr. De'Ath, of Buckingham, in which an hydatid tumour caused complete obstruction to the rectum as well as to the bladder, and although the latter organ was emptied on the evacuation of the hydatid contents, the patient died unrelieved from an enormously over-distended and ruptured colon ('Trans. Path. Society,' 1866). In April, 1870, I saw, with Mr. Phillips, of Leinster Square, a most interesting case of complete obstruction of the bowels in a lady æt. 46, caused by the presence of a large, loose, cancerous growth hanging from the peritoneum into the pelvis, covering in the promontory of the sacrum. The tumour had been regarded by an eminent physician-accoucheur as uterine. Colotomy was performed with great relief, but death took place on the third day from collapse caused by a sudden rupture of the tumour and escape of its softened contents into the peritoneal cavity. In March, 1875, I also opened the descending colon of a boy, æt. 18, for complete obstruction of the rectum from a cancerous tumour that filled the pelvis and the abdomen as high as the umbilicus. The boy survived the operation two months, dying from other causes than obstruction.

Treatment of stricture of the rectum.

TREATMENT.—It is so rare for a Surgeon to be consulted about a stricture of the rectum till either the ulcerative stage has set in, or almost complete obstruction has taken place, that he has few opportunities of testing the value of dilatation of the stricture; since this practice is clearly useless, if not injurious, under these circumstances. In cicatricial or inflammatory strictures, however, it is the only form of practice upon which reliance can be placed.

Dilatation.

Dilatation should be effected by mechanical means, but applied

with caution; forcible dilatation is inadmissible. Many instruments have been invented for the purpose, but the elastic-gum bougie is the favourite. I have, however, known so much harm to follow its use that I have abandoned it, and prefer the sponge-tent, by which a stricture can be dilated in a painless and less dangerous way. When it does not produce any irritation, a second and larger, may be passed in two days, but when irritation is set up, the repetition of the operation should be postponed till it has subsided. By these means a simple stricture may be checked in its progress, and even dilated, though rarely cured. This practice may, however, prolong life for years. Mr. Curling gives a case in which he believes he cured an annular stricture in a lady, æt. 24, by *incisions* and dilatation. I can record a case which occurred in a lady, æt. 30, who some years before had had what she called dysentery. When I saw her the rectum about one inch from the anus was narrowed by a diaphragmatic stricture which would only admit a probe. I incised this in three directions and kept it dilated with bougies. Three years later when she died, no evidence of stricture could be made out. Another case in which for two years a lady has been in complete comfort after the operation has come under my care.

Internal rectotomy.

External rectotomy.

M. Verneuil, in the 'Gazette Médicale de Paris' for January, 1873, has advocated the operation of "rectotomy" for the cure of stricture. This operation consists in an incision by means of a blunt-pointed bistoury introduced flatwise through the stricture guided by the index finger of the left hand, and the division of the entire thickness of the strictured bowel downwards and in the median dorsal line, through the anus and the sphincter; the free division of this muscle evidently playing as important a part in giving relief as the division of the stricture. Drs. C. Lente ('American Journ. of Med. Sciences,' July, 1873) and C. B. Kelsey of New York ('New York Med. Journ.,' March, 1880) have also advocated a like practice, at the same time adopting an anterior as well as posterior incision in non-malignant strictures. Dr. Kelsey's paper shows that where the disease is quite low down and within easy reach of the finger, this operation gives almost as much relief as colotomy.

Enemata.

This dilatation, however, is only a means to an end, and that end is to secure an opening for the passage of the intestinal contents. Enemata are valuable aids to effect this purpose, the daily washing out of the bowel with gruel and oil or the daily use of mist. olei with manna, confection of senna with sulphur, or any other gentle laxative that the patient by experience has found to suit, giving great relief. Cod-liver oil in full doses often acts as a laxative as well as a tonic. Care, too, should be observed in the introduction of the tube, for in a cancerous bowel perforation is very liable to occur, and even in a healthy one this accident has taken place. The Guy's Museum containing a Prep. (1877[60]), in which the colon was perforated by a bougie thirteen inches from the anus for an imaginary stricture, and a second (1877[80]), in which an O'Beirne's tube perforated the rectum five inches from the anus in an attempt to pass it up the healthy bowel to give relief in a case of obstruction after the reduction of a hernia.

Caution in use of enema tubes.

Question of allowing patient to pass tube.

How far it is safe to allow a patient to pass a bougie for him or herself is another question. I am disposed to think it is unwise to allow

it when the bougie is solid, having seen great irritation and consequently harm follow the practice, and in several cases, deep-seated suppuration. Curling has given a case where the patient caused his own death by perforating the bowel half an inch in extent above the stricture. I have consequently been in the habit of instructing my patients to use tallow candles as bougies, and have been satisfied with the practice.

Colotomy, when necessary.

There comes a time, however, when this treatment by dilatation ceases to be beneficial or when it is associated with much distress, as when the stricture has closed or ulcerated. Under these circumstances the question of *excision* of this disease or of the operation of *Colotomy* may be considered. The former operation may be discussed later on. The latter gives comfort to a degree that sometimes astonishes and always gratifies; it prolongs life, and adds materially to its comfort, and little more than this can be said of most operations; moreover it is not found to be practically associated with such inconvenience as Surgeons of old have theoretically attributed to it. But it should not be postponed till the powers of life have become so exhausted as to render poor the chances of recovery from the operation; or, till the cæcum or large intestine has become so distended as to be much damaged or inflamed. It should be undertaken as soon as it is clear that the disease has passed beyond the reach of local treatment, and the general powers of the patient are *beginning* to fail; or as soon as the local distress finds no relief from palliative measures, and a downward course is evidently approaching. The difficulties of colotomy are not great, nor are its dangers numerous; when *unsuccessful*, it has been often made so by delay in its performance from the want of power in the patient, or from the secondary effects of the disease on the abdominal viscera. When *most successful*, it gives immediate relief to most of the symptoms, and makes life worth retaining. When *least* so, it lessens pain, and renders endurable what remains of life. The operation is now established, and creditably so, to surgical art, although it must be admitted that, in the general way, it is apt to be postponed until too late a period to demonstrate its full value.

Value of operation.

When to be undertaken.

Excision of the Lower End of the Rectum.

Excision of rectum.

This operation has but recently received attention in this country as a means of cure for cancerous and other strictures of the rectum, although practised abroad by Lisfranc and others fifty years ago. It has, however, been performed by Billroth, by Dr. Levis, of Pennsylvania, and other Surgeons. Billroth reports that he lost 19 out of 45 cases of this operation, and that the majority of his cases were unsatisfactory. Cripps's statistics are more satisfactory; he records also (Jacksonian Prize Essay 1877) that, in 23 cases, defæcation was subsequently normal; in 6, that fæces could be retained when not too fluid, and in 7, that there was incontinence. With these facts, it is clear that the operation for the removal of cancerous or other disease of the rectum by excision is a justifiable and possibly a beneficial measure, and that it should be undertaken when the disease is local, and can be so defined and isolated as to come within the reach of the Surgeon's skill.

Statistics of operation.

When applicable.

When inapplicable.

It is clearly inapplicable when the disease has extended high up, and the parts around the rectum are infiltrated with cancerous disease. I quite accord with this view, and have acted upon it in four cases, all

females, with good success. All survived the operation, one for t
years, when a return took place, and the patient died from visc
cancer; one lived fourteen months; and two are now alive, twelve
thirteen months after the operation, and in comparative comfort.

It would seem that about 2½ to 3 inches of rectum may be remo
with safety, and that when the bladder is fairly distended, and tract
is made upon the rectum, the peritoneal pouch is less likely to
drawn down with it than when the bladder is empty. I have satis
myself upon these points by experiments upon the cadaver. Aft

The operation.

metallic bougie has been introduced into the bladder to serve a
guide to the position of, and to steady the urethra, an incision is t
made from the base of the scrotum to the coccyx, encircling both s
of the anal aperture. The hand of the operator may then be in
duced behind the bowel into the hollow of the sacrum, in order to
the rectum loose from its posterior attachments. By means of
finger and a pair of scissors, the adhesions all around the rec
where, on account of the disease, it may be firmly attached to
prostate gland and neck of the bladder, should be broken up.
cancerous gut should next be carefully dissected from these parts,
posing to view the prostate and the lower part of the bladder,
bleeding vessels should be carefully ligatured or torsed as soon
divided, and sutures passed through the rectum, above the prop
line of incision. These should not, however, be fastened, but lef
position to give perfect control over the parts. When the rect
including the cancerous portion, has been thus carefully and thoroug
isolated, it should be drawn down and separated by means of sciss
there is no advantage to be gained by stitching the gut to the surro
ing integuments. After the operation a good drainage tube shoul
introduced well into the posterior part of the sacral cavity, and sut
employed to bring the integuments together. The wound should
kept clean by daily irrigation.

Atony of the Colon and Dilatation of the Rectum.

Atony of colon. Dilatation of rectum.

These conditions are not unfrequently met with in practice. In
people, the colon, for want of power, often becomes enormously
tended with fæculent matter from gradual accumulation, and
condition frequently causes death. In some cases, it gives rise to
idea of stricture of the rectum, and every Surgeon must have
called to cases in which impacted fæces in the rectum and colon, a
ciated with the discharge of small, loose, offensive motions, mixed
mucus, and sometimes blood, has misled the attendant. Some y
ago, I was asked to see a lady over seventy, who had been bedri
for six months, and was supposed to be dying from constipation
stricture of the rectum, nothing but small, lumpy, and loose mot
having passed. No disease whatever existed beyond the impa
rectum and distended colon from atony of the bowel from old
The masses were mechanically removed by means of the litho
scoop and enemata of oil, &c., and she lived four years afterwards,
died simply of old age.

Treatment.

In this form of constipation, the value of nux vomica is well se
pill composed of half a grain of the extract with half a grain of b
donna, twice a week or oftener, giving tone to the intestine, and ac
as a purge.

In women specially, who have been in the habit of neglecting their bowels, and allowing the rectum to be a closed receptacle for fæculent matter, the cavity not only becomes much distended, but seems to lose the power of contracting and expelling its contents. I had, some years ago, at Guy's, a case illustrating these points. The rectum, on examination, feeling like a loose bag, large enough to admit a fist, was always full, having evidently lost all power of expulsion. The woman in young life had neglected herself, and in middle age could not overcome the effects of such neglect. By daily enemata of cold water to wash out the bowel, and the subsequent injection of an astringent liquid, such as the decoction of bark and alum, with the daily use of a pill containing half a grain of extract of nux vomica, mixed with gentian, a complete recovery took place.

The Administration of Food and Medicine by the Rectum.

Absorption by rectum.

Physiologists have long known that water, certain forms of food, and medicines are absorbed by the rectum, and physicians have acted upon this knowledge, though possibly the physiological fact has not been utilised so fully as it deserves.

It has, however, such an important bearing for good upon surgical practice, that it would be well to regard the rectum as a second stomach, and, in certain cases, to use the one for nutritive or medicinal purposes as a substitute or accessory for the other. I have for years acted upon this principle, and have every reason to be satisfied with the result. Indeed, in any case of disease or injury in which nutriment is essential, and the stomach refuses to receive or retain food, I have never hesitated to resort to the nutrient enema.

Nutrient enemata.

I do so also in cases of abdominal injury or disease, in which it is *inexpedient* to give the stomach or small intestines work to do. In aged patients, after injury or operation, when, from shock, the stomach seems incapable of doing its duty, as well as in all cases of persistent vomiting, whether after the use of anæsthetics or otherwise, it gives time for the stomach to regain its tone. The use of the nutrient enema for a few hours often tides over a slight, and for days over a great difficulty, as without doubt it supplies food to the body almost as well as the usual meal, and does so under circumstances in which the latter cannot or ought not to be administered. In a case I had with Dr. Parsons Smith, of Addiscombe, life was entirely maintained for fifteen weeks by its use; and I could adduce others in which its beneficial influence was most marked. Dr. Flint, of New York, has published one case in which life was sustained for fifteen months by this method, and he adds that during five years the patient had depended almost entirely upon it. In cases of unconsciousness from anæsthetics or otherwise, this practice should be followed in preference to any other, as it seems more than probable that, under these circumstances, any fluid which it is attempted to pour into the mouth passes into the lungs rather than into the œsophagus, and consequently hastens death.

Directions for Use.

Rules for guidance.

The bowels should be emptied by a simple enema before the nutrient one is introduced.

The nutrient enema should be used every four or six hours, and should not consist of more than four or six ounces.

The material should be tepid, and introduced *slowly*, as the rec repudiates any sudden distension.

After its administration a napkin should be pressed against the until the disposition to expel it has passed away.

When the expulsion tendency is great, five or ten drops of tincture of opium may be added to the enema; indeed, under all cumstances, it is of advantage.

At times the enema is retained better when introduced some six in into the rectum than when only just within the sphincters.

When injections are badly tolerated at first they may at time well retained if they are persisted in.

The best materials for these enemata are—milk, eggs, meat ju with pancreas or pancreatic emulsion. These may be employe different times, since it is a mistake to keep too long to one kind.

Milk and eggs, alternating with one of meat juice and panc seems to be preferable.

Darby's peptonised fluid meat is very good.

As a meat emulsion, Kaufmann's mixture is excellent, composed pound of minced or scraped beef, a third of a pound of fresh panc and half a pint of cold water. The whole allowed to macerate for quarters of an hour, gradually raised to the boiling point, and b for two minutes. The mixture will then have been reduced to the sistence of a thick soup.

When this mixture is not at hand, good beef tea or mutton may be employed, to which Liebig's extract of meat may be added

In making beef tea or broth long boiling does no good. A pou finely-minced meat macerated in half a pint of cold water for thr four hours, will give an excellent mixture; and if the whole is shaken for half an hour nearly the same result is obtained.

On several occasions I have found Slinger's, of York, nutrient positories of great use.

Rectal medication.

Rectal medication in its way is as valuable as alimentation, particularly when morphia, opium, or mercury is prescribed, former drugs administered after an operation before the influenc the anæsthetic has passed off, doing more to calm the patient and rest than any other method, more particularly in cases of abdon surgery.

The mercurial suppository employed twice a day acts on syphi patients in such a quiet and beneficial way as to lead me to look it as the best method of bringing any one under the influence of drug

END OF VOL. I.

INDEX.

ABDOMEN, injuries of, i, 683; diagnosis in, i, 683; contusions of, i, 683; penetrating wounds of, i, 695; gunshot wounds of, ii, 590; tapping, i, 728.

ABDOMINAL PARIETES, wounds of, i, 695.

ABDOMINAL VISCERA, wounds of, i, 698; protrusion of, i, 696.

ABDUCTION OF LEG in hip disease, ii, 482.

ABNORMAL ANUS, i, 699.

ABSCESS, i, 74; chronic, i, 75; alveolar, i, 668; anal, i, 797; in bone, ii, 542; in brain, i, 279; of breast, ii, 260; fæcal, i, 701; lumbar, i, 333; spinal, i, 339; perineal, ii, 144, 158; of tongue, i, 591; of kidney, ii, 64; of prostate, ii, 87; of joints, ii, 506; about joints, ii, 533; opening, i, 76; Hilton's method, i, 78.

ABSCESS KNIFE, i, 76.

ABSCISSION, i, 432.

ABSORBENT INFLAMMATION, i, 239.

ACCOMMODATION, i, 354; diseases of, i, 359.

ACETABULUM, fracture of, ii, 437; impaction of femur in, ii, 437; necrosis of, ii, 509.

ACROMION, fracture of, ii, 418.

ACTUAL CAUTERY, i, 481.

ACUPRESSURE, i, 478.

ACUTE INTERNAL STRANGULATION, i, 709.

ADAMS'S OPERATION on hip, ii, 499; for deformed nose, ii, 2; for contracted fingers, ii, 343.

ADDUCTION OF LEG in hip disease, ii, 483.

ADENITIS, i, 238; syphilitic, ii, 197.

ADENOMA, i, 165, 194; of breast, ii, 266; cystic, ii, 273; statistics of, ii, 266.

ADHESION, primary, i, 14; secondary, i, 17; repair by primary or secondary, i, 24.

ADHESIONS of iris, i, 381; of labia, ii, 247; peritoneal, ii, 295.

ADIPOSE TUMOURS, i, 160.

AIR IN VEINS, i, 561.

AIR PASSAGES, foreign bodies in, ii, 22; wounds of, ii, 19; operations on, ii, 28.

ALBUMINURIA, ii, 94; with shock, i, 302.

ALCOHOLIC DRESSING of wounds, i, 50.

ALIMENTATION, RECTAL, i, 821.

ALLARTON'S OPERATION for stone, ii, 134.

ALVEOLAR ABSCESS, i, 668.

AMALGAMS, i, 661.

AMAUROSIS, i, 390.

AMETROPIA, i, 355.

AMPUTATION in joint disease, ii, 505, 525; double, ii, 614; or excision of knee, ii, 513.

AMPUTATION, ii, 609; in collapse, i, 303; mortality of, ii, 613; of the thigh for diseases of knee, ii, 613; causes of death in, ii, 614; different varieties of, ii, 609; modes of, ii, 615; instruments required in, ii, 617; position of assistants in, ii, 618; flap operation, ii, 617; its history, ii, 610; circular operation, ii, 609; value of splints after, ii, 620; Teale's, ii, 622; Carden's, ii, 623; mixed form, ii, 623; at shoulder-joint, ii, 625; of

arm, ii, 627; at elbow-joint, ii, 627; of forearm, ii, 628; of thumb and fingers, ii, 629; at wrist-joint, ii, 629; at hip-joint, ii, 631; by Furneaux, Jordan's method, ii, 633; of thigh, ii, 634; at knee-joint, ii, 635; of leg, ii, 636; of foot, ii, 636; in gangrene, i, 94; in gunshot injuries, ii, 595; in compound fractures, ii, 404; dressing stump after, ii, 621.
AMUSSAT'S OPERATION, i, 724.
ANAL ABSCESS, i, 797.
ANÆSTHESIA, LOCAL, ii, 608.
ANÆSTHETICS, action of, ii, 600; rules for administration of, ii, 602; value of, as aids to diagnosis, ii, 605; improvements in practice due to, ii, 605; in eye surgery, i, 397.
ANASTOMOSIS, aneurism by, i, 523.
ANATOMICAL TUBERCLE, i, 124.
ANCHYLOSIS of spine, i. 334; of hip ii, 485, 498; of knee, ii, 504.
ANEL'S OPERATION for aneurism, i, 512.
ANEURISM, i, 493; pathology of, i, 494; diagnosis of, i, 499; diffused, i, 518, 494; dissecting, i, 494; traumatic, i, 517; false, i, 493; true, i, 493; varicose, i, 521; rupture of, i, 499; spontaneous cure of, i, 497; by anastomosis, i, 523; fusiform, i, 494; arterio-venous, i, 520; cirsoid, i, 523; special, i, 529; treatment of, 501; by ligature, i, 511; by compression, i, 502; by manipulation, i, 515; by injection, i, 516.
ANEURISM NEEDLE, i, 531.
ANEURISMAL SAC, relations of, to artery, i, 493.
ANEURISMAL VARIX, i, 520.
ANGEIOLEUCITIS, i, 238.
ANGULAR CURVATURE of spine, i, 332.
ANIMAL POISONS, i, 122.
ANKLE-JOINT, dislocations of, ii, 385; diseases of, ii, 489; suppuration of, ii, 517; excision of, ii, 518; amputation at, ii, 643.
ANKYLOGLOSSIS, i, 584.
ANNULAR URETHRAL STRICTURE, ii, 142; rectal ii, 816.
ANTISEPTIC IRRIGATION, i, 23-52.
ANTISEPTIC LIGATURE, i, 472.
ANTRUM, diseases of, i, 621; drop of, i, 621; suppuration of, i, 621
ANTYLLUS, OPERATION OF, for aneurism i, 514.
ANUS, artificial, i, 699; abnormal anu i, 699; imperforate, i, 786; disea about, i, 792; fistula about, i, 797 painful ulcer of, i, 794; pruritu of, i, 812.
AORTA, abdominal aneurism of, i, 53 ligature of, i, 532; compression o i, 533.
APHASIA after head injury, i, 265.
APHTHOUS STOMATITIS, i, 580.
APNŒA, ii, 48, 49.
ARACHNITIS, i, 276, spinal, i, 316.
ARACHNOID CYSTS, i, 270.
ARCH, PALMAR, wounds of, i, 547.
ARM, amputation of, ii, 627.
ARREST OF GROWTH after fracture, 425.
ARREST OF INFLAMMATION by obstru tion of artery, i, 79.
ARROWS, wounds from, i, 202.
ARTERIAL OR ANÆMIC GANGRENE, 93; Pyæmia, i, 491.
ARTERIES, diseases of, i, 486; infla mation of, i, 486; atheroma of 488; injuries of, i, 468; contus of, i, 470; torsion of, i, 473; s tistics of, i, 480; ligature of, 472; general rules for the ligat of, i, 529; occlusion of, i, 47 subcutaneous rupture of, i, 47 hæmorrhage from, i, 468, 473.
ARTERIO-VENOUS ANEURISM, i, 520.
ARTERITIS AND ATHEROMA, i, 486.
ARTERY CONSTRICTOR, i, 480.
ARTHRITIS, GONORRHŒAL, ii, 190.
ARTHRITIS OSTEO-, ii, 530.
ARTICULAR ENDS OF BONES, disease ii, 474; necrosis of, ii, 538.
ARTIFICIAL ANUS, i, 699.
ARTIFICIAL LEECH, i, 398.
ARTIFICIAL PUPIL, i, 419.
ARTIFICIAL RESPIRATION, ii, 50.
ASPHYXIA, ii, 48.
ASPIRATOR IN ABSCESS, i, 77.
ASTRAGALO-CALCANEAN JOINT, dis of, ii, 489; dislocation of, ii, 3
ASTRAGALUS, dislocation of, ii, 3 fracture of, ii, 464; excision of 392.
ATHEROMA, i, 488.

ATLAS, disease of, i, 334; dislocation of, i, 323.
ATROPHY of bone, ii, 566; of muscle, ii, 311.
ATROPINE in iritis, i, 382.
AURAL POLYPI, i, 455.
AURICLE, malformations of, i, 443; tumours of, i, 444.
AXILLARY ARTERY, ligature of, i, 542.

BACK, injuries of, i, 313; sprains of, i, 328.
BALANITIS, ii, 190.
BANDAGE, spica, i, 758; suspensory, ii, 216; immovable, ii, 407.
BARBADOES LEG, i, 233.
BASE OF SKULL, fractures of, i, 255.
BASEDOW'S DISEASE, i, 243, 438.
BATH, CALOMEL, i, 142.
BAVARIAN IMMOVABLE flannel splint, ii, 407; for knee, ii, 503.
BEDSIDE EXPERIENCE, i, 4.
BEDSORES, i, 90.
BELLOCQ'S instrument for plugging nose, ii, 4.
BENDING OF BONES, ii, 569.
BICEPS TENDON, rupture of, ii, 307.
BIGELOW'S lithotrity, ii, 116.
BITES, SERPENT, i, 125.
BLADDER, diseases of, ii, 67; rupture of, i, 691; irritable ii, 67; in women, ii, 257; inflammation of, ii, 69; sacculated, ii, 70; washing out, ii, 71; ulceration of, ii, 73; tumours of, ii, 74; villous growths of, ii, 74; cancer of, ii, 75; atony of, ii, 82; tubercular disease of, ii, 73; paralysis of, ii, 83; stone in, ii, 108; foreign bodies in, ii, 139; malformations of, ii, 182; gunshot wounds of, ii, 592; on bladder puncturing through rectum, ii, 172; above pubes, ii, 175.
BLEEDING, arrest of, in wounds, i, 24; the operation of, i, 568; in head injuries, i, 278, 281; in wound of lung, ii, 41.
BLEPHAROPHYMOSIS, i, 403.
"BLOC, REDUCTION EN," i, 759.
BLOOD CYSTS in skull, i 270.
BLOOD-POISONING, i, 108; prevention of, i, 119.
BLOOD TUMOURS of scalp, i, 250.
BODIES, LOOSE, in joints, ii, 525; in bursæ, ii, 320; in ganglion, ii, 325.
BOILS, i, 220; Delhi, i, 224.
BONE, atrophy of, ii, 566; abscess of, ii, 542; contusions of, of skull, i, 252; diseases of, ii, 535; inflammation of, ii, 537; elongation of, from inflammation, ii, 567; fractures of, ii, 396; hypertrophy, ii, 566; caries of, ii, 552; necrosis of, ii, 537; sclerosis of, ii, 539; tumours of, ii, 554; diagnosis of, ii, 563; pulsatile tumours of, ii, 565; cysts in, ii, 565; hydatids in, ii, 565; cancer of, ii, 560; amputation in, ii, 564.
BONE-SETTING, ii, 598.
BOWEL, internal strangulation of, i, 709; ruptured, i, 688.
BRACHIAL ARTERY, ligature of, 544.
BRAIN, bruised, i, 263; hæmorrhage from, i, 263; from meningeal artery, i, 267; concussion of, i, 261, 280; compression of, i, 271, 280; hernia of, i, 275; inflammation of, i, 276; suppuration of, i, 280; wounds of, i, 274.
BRAIN AND ITS MEMBRANES, injuries of, i, 266.
BRASDOR'S OPERATION, i, 512.
BREAST, diseases of, ii, 258; Creighton's views of their pathology, ii, 262; hypertrophy of, ii, 268; engorgement of, ii, 258; inflammation of, ii, 259; abscess of, ii, 259; submammary abscess of, ii, 261; chronic induration of, ii, 262; the irritable, ii, 262; tumours of, ii, 262; adenoma of, ii, 266; statistics of, ii, 266; cancer of, ii, 270; open cancer of, ii, 277; statistics of, ii, 272; colloid cancer of, ii, 273; cystic disease of, ii, 273; cystic cancer, ii, 276; sarcoma of, ii, 276; milk tumour of, ii, 275; hydatids of, ii, 277; retracted nipple in, ii, 278; discharge from nipple in, ii, 279; enlarged glands in, ii, 280; infiltration of skin in, ii, 280; chronic eczema of nipple preceding cancer, ii, 279; excision of, ii, 280.
BREAST, tumours of, diagnosis of, ii, 265.

BROAD LIGAMENT, cysts of, ii, 286.
BRONCHOCELE, i, 245.
BRONCHOTOMY, ii, 32.
BRUISE, i, 200.
BUBO, in clap, ii, 190; in chancre, ii, 197; in syphilis, ii, 197.
BUBONOCELE, i, 736.
BULLETS, varieties, ii, 576; extractor, ii, 583.
BUNION, i, 228.
BURNS AND SCALDS, i, 203; statistics of, i, 205; cause of death in, i, 205; pathology of, i, 205; of larynx, ii, 27.
BURROWING OF ABSCESS, i, 75.
BURSÆ, diseases of, ii, 318; of synovial, ii, 320; of popliteal, ii, 322; acute inflammation of, ii, 318, 533; loose bodies in, ii, 320.
BUTTON SUTURE, i, 29.

CACHEXIA, i, 6.
CÆCUM, abscess about, i, 701; rupture of, i, 713; hernia of, i, 736.
CALCIS, fractures of, ii, 464; necrosis of, ii, 552.
CALCULUS, nasal, ii, 8; salivary, i, 582; in tonsil, i, 615; renal, ii, 59, 100; prostatic, ii, 92; vesical, ii, 101; urethral, ii, 175; in female, ii, 137.
CALLISEN'S OPERATION, i, 724.
CALLOUS ULCERS, i, 85.
CALLUS, provisional, ii, 410.
CALOMEL BATH in syphilis, i, 142.
CANALICULI, obstruction of, i, 404.
CANCER, i, 171, 198; its structure, i, 198; its causes, i, 180; heredity in, i, 180; its clinical features, i, 172; its treatment, i, 181; scirrhous, i, 173; medullary, i, 174; osteoid, i, 193; epithelial, i, 176; colloid, i, 179; villous, i, 180; of lip, i, 576; of nose, ii, 6; of œsophagus, i, 676; of tongue, i, 599; of tonsil, i, 606; of rectum, i, 814; of bladder, ii, 75; of prostate, ii, 94; of penis, ii, 180; of breast, ii, 270; of testicle, ii, 230; of thyroid gland, i, 247; of bone, ii, 560; of scrotum, ii, 242; treatment by excision, i, 181; by caustics, i, 182.
CANCRUM ORIS, i, 579.
CANNON BALLS, blows from, ii, 578.
CARBOLISED LIGATURES, i, 472.
CARBUNCLE, i, 221; facial, i, 223, 57
CARCINOMA, i, 171, 198.
CARDEN'S AMPUTATION, ii, 623.
CARDINAL POINTS (six) to be observ in the treatment of wounds, i, 2
CARIES, ii, 552; caustic treatment ii, 554; of teeth, i, 659.
CAROTID ARTERY, ligature of, i, 5 538.
CARPUS, dislocation of, ii, 371; d eases of, ii, 492, 523.
CARR'S SPLINT for fracture of forear ii, 430.
CARTILAGE, diseases of, ii, 472; dis cations of inter-articular, ii, 3 tumours of, i, 163, 193; ii, 5 fracture of costal, ii, 41.
CARTILAGES, loose, in joints, ii, 525.
CARTILAGES, STERNO-COSTAL, fract of, ii, 41.
CASTRATION, ii, 237.
CATARACT, i, 420; operations for 423; accidents during, i, 4 after treatment, i, 430.
CATARACT GLASSES, i, 430.
CATARRH OF TYMPANUM, i, 459.
CATARRHAL CONJUNCTIVITIS, i, 36
CATGUT SUTURES, i, 29; ligature, c bolised, i, 472.
CATHETERS, ii, 145; on passing, 146; tying in, ii, 148; Eustachi i, 460.
CAUSTICS, i, 182.
CAUTERY, actual, i, 481; galvanic, fistula, i, 800; in piles, i, 806; skin cancer, i, 183; in ovariotc ii, 298.
CELL DEVELOPMENT, i, 14.
CELLULAR MEMBRANOUS SORE, i, 83.
CELLULITIS, i, 102.
CERVICAL CYSTS, i, 185.
CERVICAL VERTEBRÆ, diseases of, 333, 339.
CERVIX FEMORIS, fracture of, ii, 43
CHANCRE, ii, 192; of lip, i, 578; fecting, ii, 192; complications ii, 195.
CHARBON, or malignant pustule, i, 1
CHARCOT'S disease of joints, ii, 532.
CHEILOPLASTIC OPERATIONS, i, 575.
CHELOID TUMOURS, i, 211; of ear, 448.

CHEST, injuries of, ii, 37; deformities of, ii, 45; gunshot injuries of, ii, 589; wounds of, ii, 42; of large vessels of, i, 467; tapping, ii, 46.
CHIGOE, i, 236.
CHILBLAIN, i, 218.
CHILDREN, hydrocele in, ii, 200; irritable bladder in, ii, 67; incontinence in, ii, 85; lithotomy in, ii, 113; retention in, ii, 167, 170; extravasation in, ii, 175.
CHIMNEY SWEEP'S CANCER, i, 242.
CHLOROFORM, ii, 600; value of, in strangulated hernia, i, 748.
CHOKED DISC, i, 394.
CHOPART'S amputation, ii, 640.
CHORDEE, ii, 189.
CHOROID, hyperæmia of, i, 383; injuries of, i, 384.
CHOROIDITIS, i, 383.
CHRONIC ABSCESS, i, 73.
CHRONIC INTESTINAL OBSTRUCTION, i, 712.
CICATRICES, diseases of, i, 209; division of, i, 209; congenital, i, 213, 571.
CICATRICIAL STRICTURE of urethra, ii, 162; of œsophagus, i, 677.
CICATRISATION, i, 15.
CIRCUMCISION, ii, 178.
CIRSOID ANEURISM, i, 523.
CIVIALE'S LITHOTRITY, ii, 113.
CLAMP, for ovariotomy, ii, 297; for piles, i, 806.
CLAVICLE, dislocation of, ii, 354; fracture of, ii, 415.
CLAW-LIKE EXTREMITIES, ii, 327.
CLEANSING WOUNDS, i, 22.
CLEFT PALATE, i, 606.
CLINICAL HISTORY, value of, i, 3.
CLITORIDECTOMY, ii, 250.
CLITORIS, enlargement of, ii, 250; cancer of, ii, 250.
CLOACÆ in bone, ii, 536.
CLOTS, "active and passive," in aneurism, i, 497.
CLOVER'S lithotrity syringe, ii, 59.
CLOVE-HITCH, ii, 363.
CLUB-FOOT, ii, 330.
COAPTATION OF WOUNDS, i, 26.
COCCYDYNIA, ii, 491.
COCCYGEAL JOINT, disease of, ii, 490.
COCCYGEAL TUMOURS, i, 311.
COCK'S OPERATION for stricture, ii, 155.
COHNHEIM'S VIEWS on inflammation, i, 73.
COLD as a local application, i, 48; as a styptic, i, 481; as an anæsthetic, ii, 608.
COLD ULCERS, i, 88.
COLECTOMY, i, 721.
COLE'S ARTERY COMPRESSOR, i, 504.
COLLAPSE, i, 301; amputation in, ii, 303.
COLLATERAL CIRCULATION, i, 519.
COLLES' fracture, ii, 426.
COLLOID CANCER, i, 179.
COLOBOMA, i, 379.
COLON, rupture of, i, 689.
COLOTOMY, i, 723; for stricture, i, 819; plug for, i, 725.
COMA, i, 271.
COMMINUTED FRACTURES, ii, 467.
COMPOUND FRACTURES, ii, 404; of skull, 257.
COMPOUND DISLOCATION, ii, 352; of shoulder, ii, 365; of elbow, ii, 369; of knee, ii, 384; of ankle, ii, 388.
COMPRESS, DIX'S, wire, i, 479.
COMPRESSION in aneurism, i, 502.
COMPRESSION OF BRAIN, i, 271; diagnosis of, i, 273; treatment of, i, 280; of chest, ii, 44.
CONCUSSION OF BRAIN, i, 261; hæmorrhage as result of, i, 263; treatment of, i, 280; remote effects of, i, 266; of spine, i, 313.
CONDYLOMATA, i, 143, 811.
CONGENITAL anomalies of eyelids, i, 362; of lips, i, 570; malformations, ii, 327; of joints, ii, 394; hydrocele, ii, 200; tumours, i, 311; cicatrices, i, 213, 571; hernia, i, 765; syphilis, i, 149; sebaceous cysts, i, 188.
CONICAL CORNEA, i, 414.
CONJUNCTIVA, disease of, i, 364; operations on, i, 407; injuries of, i, 369.
CONJUNCTIVITIS, varieties of, i, 364.
CONSTITUTIONAL, causes of non-repair in wounds, i, 20; sores, i, 83.
CONTAGIOUS OPHTHALMIA, i, 368.
CONTINUOUS SUTURE, i, 27.
CONTRACTION OF BOWEL, i, 714; after strangulation, i, 746; of fingers, ii, 343.
CONTRECOUP, i, 256, 264, 277.
CONTUSED WOUNDS, i, 35.

CONTUSION, i, 200; of brain, i, 264; of scalp, i, 250; of bones of skull, i, 252; of chest, ii, 37; of arteries, i, 470.
CONVULSIONS in head injuries, i, 263, 268, 271, 277.
CORACOID PROCESS, fracture of, ii, 418.
CORD, SPERMATIC, varicocele of, ii, 238; tumours of, ii, 240; hydrocele of, ii, 198, 202; hæmatocele of, ii, 211.
CORD, SPINAL, injuries of, i, 313.
CORNEA, inflammation of, i, 371; ulcers of, i, 374; conical, i, 414; opacities of, i, 375; tinting, i, 415; wounds of, i, 375; burns of, i, 376; operations on, i, 413; foreign bodies in, i, 415.
CORNS, i, 227.
CORONOID PROCESS OF JAW, fracture of, i, 634.
CORONOID PROCESS OF ULNA, fracture of, ii, 433.
CORTICAL CATARACT, i, 422.
CRANIUM, injuries of, i, 253; general propositions on, i, 253; contusion of, i, 252; fracture of, i, 254; compound of, i, 257; fracture of base of, i, 255; diagnosis of, i, 257; incomplete fracture of, ii, 397; gunshot injuries of, ii, 585.
CREPITUS of fracture, ii, 401.
CROFT'S SPLINT, ii, 409.
CROUP, ii, 30.
CRUSHING PILES, ii, 807.
CURVATURE OF SPINE, i, 329, 332; Sayre's jacket in, i, 336.
CUTANEOUS CYSTS, i, 188.
CUT THROAT, ii, 19.
CUTTING TEETH, i, 649.
CYCLITIS, i, 384.
CYNANCHE TONSILLARIS, i, 613.
CYSTIC DISEASE of breasts, ii, 273; of antrum, i, 621; of testes, ii, 227; of ovary, ii, 282.
CYSTINE CALCULUS, ii, 105.
CYSTITIS, ii, 69.
CYSTS, as tumours, i, 185; serous, i, 185; simulating encephalocele, i, 291; dentigerous, i, 622, 643, 653; thyroid, i, 186; mucous, i, 187; oil, i, 189; sublingual, i, 581; sebaceous, i, 105; tarsal, i, 399; of orbit, i, 439; labial, ii, 248.
DAVIES-COLLEY'S talipes splin operation for talipes equi ii, 339.
DEAF-MUTISM, i, 465.
DECAY OF TEETH, i, 659.
DEFORMITIES, ii, 327; heredi 329; of nose, ii, 1; of che
DELHI BOIL, i, 224.
DELIRIUM TREMENS, i, 298.
DENTAL CARIES, i, 659.
DENTAL IRRITATION, i, 655; effects of, i, 656.
DENTAL SURGERY, remarks on,
DENTIGEROUS, CYSTS, i, 622, 6 tumours, i, 624.
DENTINE, SECONDARY, i, 658.
DEPOSITS, urinary, ii, 96.
DEPRESSED FRACTURE of skull 271; trephining for, i, 28
DERMAL OR DERMOID CYSTS, i, bladder, ii, 79.
DIAGNOSIS, i, 1; by exclusion,
DIAPHRAGM, rupture of, i, 694
DIAPHRAGMATIC HERNIA, i, 78
DIATHESIS, i, 5; scrofulous, i, morrhagic, i, 6.
DIEULAFOY'S ASPIRATOR, i, 77.
DIFFUSE CELLULAR INFLAMM 102.
DIFFUSED ANEURISM, i, 494.
DIGITAL COMPRESSION of aneu 503.
DILATATION OF STRICTURE, for 149.
DIPHTHERITIC CONJUNCTIVIT
DIRECT INGUINAL HERNIA, i, 7
DIRECT OPHTHALMOSCOPIC EX TION, i, 348.
DISLOCATIONS, ii, 349; of spine of jaw, i, 631; of ribs, ii, duction of old, ii, 351-2 pound, ii, 352; of clavicle, of scapula, ii, 356; of h ii, 357; of elbow, ii, 365; o ii, 369; of radius, ii, 370; pal bones, ii, 370; of thu phalanges, ii, 371; of hip, of old dislocations of hip, treatment of, ii, 378; fract dislocation of, ii, 381; of ii, 382; of knee-joint, ii, 3 fibula, ii, 384; of foot at ii, 385; of astragalus, ii, 3 foot off astragalus, ii, 389;

sal joints, ii, 393; unreduced, ii, 351; reduction by manipulation of hip, ii, 379; of humerus, ii, 362.
Dislocation and fracture, ii, 353; of humerus, ii, 365, 425; of hip, ii, 381.
Displaced hernia, i, 759; reduction *en masse*, i, 760; other varieties, i, 760.
Displacement of femur in hip disease, ii, 483.
Dissecting aneurism, i, 494.
Dissection wounds, i, 123.
Distal ligature, i, 515; pressure, i, 509.
Dix's wire compress, i, 479, 509.
Dolbeau's perineal lithotrity, ii, 134.
Dorsalis pedis artery, ligature of, i, 555.
Dorsum ilii, dislocation on, ii, 375.
Double splint for fracture of thigh, ii, 445; statistics of results, ii, 441, 448; for hip disease, ii, 496.
Douche, nasal, ii, 3.
Drainage of wounds, i, 31; tubes, i, 31; caution in their use, i, 31; tubes in abscess, i, 79; after amputation, ii, 620.
Dressing wounds, i, 22; second, i, 33; later, i, 35.
Dropsy, diagnosis of ovarian, ii, 284
Drowning, ii, 48; recovery from, ii, 48.
Dry dressing of wounds, i, 49.
Dry gangrene, i, 93, 95.
Duchenne's disease, ii, 312.
Dugas's guide to diagnosis of dislocation of humerus, ii, 361.
Duodenum, ulceration of, i, 204; rupture of, i, 688.
Dura mater, injuries of, i, 266; inflammation of, after ostitis, i, 276; blood outside, i, 267; within, i, 269.
Durham's tracheotomy canula, ii, 34.
Dyspeptic ulcer of tongue, ii, 593.
Dysphagia, i, 675.

Ear, external, affections of, i, 443; malformations of, i, 443; cutaneous affections of, i, 444; injuries of, i, 445; tumours of, i, 445; cheloid tumours, i, 446; hæmatoma, i, 445.
Ear, foreign bodies in, i, 448; polypus in, i, 455; bleeding from, in fractured skull, i, 258.
Ear, middle, affections of, i, 455; catarrh of, i, 459.
Ear-ring holes, tumours of, i, 446.
Earth-dressing of wounds, i, 50.
Ecchymosis, i, 200.
Echinococcus, i, 237.
Ectopion vesicæ, ii, 182.
Ectropion, i, 401.
Eczematous ulcer, i, 87.
Elastic extension, ii, 448.
Elastic ligature in fistula, i, 800.
Elbow-joint, amputation at, ii, 627; excision of, ii, 520; dislocation of, ii, 365; compound dislocations of, ii, 369; compound fractures into, ii, 433; diseases of, ii, 492, 504.
Electric indicators, ii, 583.
Electrolysis in aneurism, i, 516; in stone, ii, 112; in hydatid, i, 731.
Electro-puncture of aneurism, i, 516.
Elephantiasis arabum, i, 232; Manson's views on, i, 235; ligature of main artery in, i, 233; of scrotum, ii, 241; Græcorum, i, 232.
Embolism, i, 490; pulmonary, i, 491; fat, in fracture, ii, 401.
Emigration of leucocytes, i, 14.
Emissions, nocturnal, ii, 245.
Emmetropia, i, 354.
Emphysema, ii, 39.
Empyema, ii, 46.
Encephalitis after injury, i, 276.
Encephalocele, i, 289.
Encephaloid cancer, i, 174.
Enchondromata, i, 163, 193; of bone, ii, 557; of jaw, i, 625.
Encysted hernia, i, 766; hydrocele, ii, 206.
Endostitis, ii, 544.
Enostosis, ii, 15.
Enterocele, i, 736.
Entero-epiplocele, i, 736.
Enterotomy, i, 719; in malformations of rectum, i, 789.
Entropion, i, 400.
Enucleation of eyeball, i, 431.
Epididymitis, ii, 213; in gonorrhœa, ii, 189.
Epigastrium, blows on, i, 684.
Epiglottis, wounds of, ii, 20.

EPILEPSY, trephining in, i, 292; after injury, i, 283.
EPIPHYSIAL CARTILAGE, disease of, in hip disease, ii, 481.
EPIPHYSIS, inflammation of, ii, 535; displacement of, ii, 353; of humerus, ii, 369, 420; of clavicle, ii, 356; of radial, ii, 426; of femur, ii, 384, 446; arrest of growth of bone from injury of, ii, 425.
EPIPLOCELE, i, 736.
EPISCLERITIS, i, 376.
EPISPADIAS, ii, 182.
EPISTAXIS, ii, 3; plugging nose in, ii, 4; in head injuries, i, 259.
EPITHELIOMA, i, 176; of bone, ii, 560; of nose, ii, 11; of lips, i, 576; of penis, ii, 180; of scrotum, ii, 242; of rectum, i, 814; of tongue, i, 599; of œsophagus, i, 676.
EPULIS, i, 619, 671.
EQUINIA or glanders, i, 131; mitis, i, 133.
ERECTILE TUMOUR, i, 525.
ERYSIPELAS, i, 99; thermography of, i, 100; phlegmonous, i, 102; pathological appearances after, i, 103; treatment of, i, 105.
ERYTHEMA, i, 107; nodosum, i, 108; varieties of, i, 108.
ESMARCH'S BANDAGE, i, 475; in aneurism, i, 506; operation for closure of jaws, i, 631.
ETHER SPRAY, ii, 608.
EUSTACHIAN CATHETER, passage of, i, 460.
EXCISION OF JOINTS, ii, 505; of hip, ii, 508; of knee, ii, 515; of ankle, ii, 518; of shoulder, ii, 519; of elbow, ii, 520; of wrist, ii, 524; of larynx, ii, 32.
EXCLUSION, reasoning by, i, 2.
EXFOLIATION OF BONE, ii, 536.
EXOPHTHALMIC BRONCHOCELE, i, 245.
EXOSTOSIS, ii, 555; periosteal, ii, 556; cranial, ii, 555; of ungual phalanx, i, 252; ii, 556; statistics of, ii, 557; fracture of, ii, 556; of orbit, i, 438; of meatus, i, 452.
EXTERNAL MEATUS, examination of, i, 447; affections of, i, 447.
EXTERNAL PILES, i, 801.
EXTERNAL URETHROTOMY, ii, 152.
EXTRA-CAPSULAR FRACTURE, ii, 438.
EXTRACTION OF CATARACT, i, 42 after-treatment of, i, 430; of tec i, 651, 671.
EXTRAVASATION of blood, i, 200; fracture, ii, 465; of urine, ii, 15 of urine in children, ii, 175.
EXTROVERSION OF BLADDER, ii, 182.
EYE, injuries and diseases of, i, 346.
EYEBALL, examination of, i, 346; o rations on, i, 396; position patient in, i, 396.
EYEBALL, rupture of, i, 431; suppu tion of, i, 442; extirpation of 431; protrusion of, i, 433; mours of, i, 440; vascular p trusion of, i, 436.
EYELASHES, malposition of, 399.
EYELIDS, diseases of, i, 362; tumo of, i, 399; injuries of, i, 363; amination of, i, 346; formation new, i, 402.

FACIAL ARTERY, ligature of, i, 539.
FACIAL CARBUNCLE, i, 223.
FACIAL NERVE, paralysis of, i, 258, 5
FÆCAL ABSCESS, i, 701.
FÆCAL FISTULA, i, 699.
FÆCAL IMPACTION, i, 713.
FALSE JOINT after dislocation, ii, 3 after fracture, ii, 412.
FARCY, i, 131.
FASCIA OF PALM, contraction of, 343; Adams' operation for, 344.
FAT EMBOLISM in fracture, ii, 401.
FATTY TUMOUR, i, 160.
FAUCES, ulceration of, i, 612.
FEIGNED DISEASE, i, 305.
FEMALE GENITAL ORGANS, affectio of, ii, 246.
FEMALE, stone in, ii, 137.
FEMORAL ANEURISM, i, 547.
FEMORAL ARTERY, ligature of, i, 551.
FEMORAL HERNIA, i, 773; diagnosis, 774; strangulated, i, 774.
FEMUR, dislocations of head of, ii, 37 fractures of, ii, 438; of neck, 438; of shaft, ii, 447; of condyl ii, 452; in children, ii, 451; co pound, of, ii, 453; separation epiphysis of head, ii, 446; trochanter, ii, 445; of condyl ii, 452; absorption of neck, 445.

FEVER, inflammatory, i, 70, 108; hectic, i, 120; traumatic, i, 13, 110.
FIBRIN, excess of, in inflammation, i, 71.
FIBROMATA, i, 161.
FIBRO-MUSCULAR TUMOUR, i, 162.
FIBRO-PLASTIC TUMOUR, i, 168.
FIBROUS POLYPUS of pharynx, ii, 10.
FIBROUS TUMOURS, i, 163; of uterus, ii, 301.
FIBULA, dislocation of head of, ii, 384; fracture of ii, 459.
FIELD DRESSING, first, ii, 581.
FINGERS, compound fracture of, ii, 434; amputation of, ii, 629; contracted, ii, 343; dislocation of, ii, 372; webbed, ii, 328.
FIRST INTENTION, union by, i, 14.
FISSURE OF ANUS, i, 794.
FISSURED PALATE, i, 606.
FISTULA, i, 80; rectal, i, 797; fæcal, i, 699; salivary, i, 582; urinary, ii, 160; vaginal, ii, 253; vesico-intestinal, ii, 84.
FLAP AMPUTATION, ii, 610.
FLAT FOOT, i, 341.
FLEXION IN ANEURISM, i, 508; in reduction of dislocation of hip, ii, 379.
FLUCTUATION, i, 75.
FOLLICULAR TUMOURS, i, 184.
FOOT, fractures of, ii, 464; dislocation of, ii, 385; perforating ulcer of, i, 224; amputations of, ii, 636.
FORCEPS, artery, i, 476; bone, ii, 551; bullet, ii, 583; lion, i, 626; pharyngeal, i, 679; tooth, i, 673; tracheal, ii, 26; omental clamp, ii, 297.
FORCIBLE TAXIS, i, 749.
FOREARM, amputation of, ii, 628; fractures of, ii, 426; compound, of ii, 433.
FOREIGN BODIES in conjunctiva, i, 370; in ear, i, 449; in nose, ii, 7; in pharynx and œsophagus, i, 678; in air-passages, ii, 22; in bladder, ii, 139; in rectum, i, 792; in stomach and intestines, i, 702; in gunshot injuries, ii, 584; in wounds, i, 19.
FRACTURE BED, ii, 405.
FRACTURE OF EXOSTOSES, ii, 556.
FRACTURE with ruptured artery, i, 518.
FRACTURES, ii, 396; incomplete, ii, 397; impacted, ii, 398; diagnosis of, ii, 399; prognosis, ii, 401; treatment of simple, ii, 402; in insane, ii, 399; of compound, ii, 404; from gunshot injuries, ii, 593; repair of, ii, 410; of compound, ii, 412; delayed union in, and ununited, ii, 412; deformity after, ii, 414; complicating joints, ii, 405, 466; extravasation in, ii, 465; comminution of bone in, ii, 467; spontaneous, ii, 398; fat-embolism in fracture, ii, 401.
FRACTURES, SPECIAL, of jaws, i, 633; of nose, ii, 1; of skull, i, 254; of base of skull, i, 255; compound, of skull, i, 257; of spine, i, 320; of larynx, ii, 18; of ribs, ii, 38; of clavicle, ii, 415; of scapula, ii, 417; of humerus, ii, 419; of radius and ulna, ii, 426; compound, of arm, ii, 433; from gunshot injuries, ii, 593; of metacarpal bones, ii, 432; of phalanges, ii, 432; compound, ii, 435; of lower extremity, ii, 437; statistics of, ii, 401, 438; of pelvis, ii, 435; of femur, ii, 438; of leg, ii, 458; of patella, ii, 454; of foot, ii, 464; gunshot fractures, ii, 593; splints in, ii, 405; immovable splints, ii, 406; Colles's ii, 426; Pott's, ii, 385.
FRONTAL SINUS, diseases of, ii, 14; distension of, ii, 14; fracture of, ii, 2; enostosis of, ii, 15.
FROSTBITE, i, 93, 219.
FULMINATING GLAUCOMA, i, 388.
FUMIGATION, mercurial, i, 142.
FUNGUS FOOT of India, i, 225.
FURNEAUX JORDAN'S method of amputation at the hip-joint, ii, 633.
FURUNCLES of ear, i, 451.
FURUNCULUS, or boil, i, 220.
FUSIBLE CALCULUS, ii, 106.
FUSIFORM ANEURISM, i, 494.

GAG, i, 607.
GALACTOCELE, ii, 275.
GALL-BLADDER, rupture of, i, 691.
GALL-DUCT, rupture of, i, 691.
GALVANIC CAUTERY, in fistula, i, 800; in cancer, i, 181; in nævus, i, 526; in piles, i, 806.

GALVANO-PUNCTURE in aneurism, i, 516.
GANGLION, ii, 324; diffused, ii, 325.
GANGRENE, anæmic or arterial, i, 93, 95; static or venous, i, 93, 96; from cold, i, 93, 219; traumatic, i, 92; after ligature, i, 513; embolic, i, 490; hospital, i, 96; senile, i, 93; amputation in, i, 96.
GASTROTOMY and GASTROSTOMY, i, 704.
GENITALS, FEMALE, affections of, ii, 246; wounds of, ii, 246; foreign bodies in, ii, 247; adherent labia, ii, 247; vulvitis, ii, 247; noma, ii, 247; labial cysts, &c., ii, 248; labial tumours, ii, 248; imperforate hymen, ii, 249; double vagina, ii, 249; vaginal tumours, ii, 250.
GENITO-URINARY ORGANS, injuries and diseases of, ii, 170; malformations of, ii, 182; development of, ii, 213.
GENUFLEXION in popliteal aneurism, i, 508.
GLANDERS, i, 131.
GLANDS, inflammation of, i, 238; in erysipelas, i, 104.
GLANDULAR TUMOURS, i, 165.
GLAUCOMA, i, 386.
GLEET, ii, 187.
GLIOMA, i, 440.
GLOSSITIS, i, 592.
GLOTTIS, foreign bodies in, ii, 22; scalds of, ii, 27.
GLUTEAL ANEURISM, ligature of internal iliac in, i, 549.
GOITRE, i, 243; exophthalmic, i, 243, 438.
GONORRHŒA, ii, 186; in female, ii, 187; complications of, ii, 189.
GONORRHŒAL RHEUMATISM, ii, 190.
GORDON'S SPLINT for fracture of radius, ii, 430.
GOUTY, PHLEBITIS, i, 559; testitis, ii, 220.
GOWAN'S EXCISION SAW, ii, 905.
GRAFTING-SKIN, i, 213.
GRANULAR LIDS, i, 366.
GRANULATING WOUNDS, i, 16; treatment of, i, 37, 41.
GRANULATION TUMOURS, ii, 184.
GRANULATIONS, i, 16, diseases of, i, 69.
GRAVEL, ii, 100.
GREEN-STICK FRACTURE, ii, 397
GRITTI'S AMPUTATION, ii, 634.
GROSS'S TRACHEAL FORCEPS, ii
GROWTH, arrest of, after fra
425; after disease of hip,
GUINEA-WORM, i, 235.
GUM AND CHALK SPLINT, ii, 4
GUMBOIL, i, 617.
GUMMATA, i, 140.
GUMS, affections of, i, 617, 67
GUNPOWDER, burns from, i, 2
GUNSHOT INJURIES, ii, 574; s
ii, 579; hæmorrhage in,
of head, ii, 585; of chest,
of heart, ii, 590; of abd
590; of intestines, ii,
bladder, ii, 592; fracture
ii, 593; of upper extre
594; of lower, ii, 594; am
in, ii, 596.
GUSTATORY NERVE, division of,
HÆMATOCELE, ii, 210; of the
211.
HÆMATOMA OF SCALP, i, 250;
446.
HÆMATURIA, ii, 56, 76.
HÆMOPHILIA, i, 6.
HÆMORRHAGE, i, 473; consec
62; secondary, i, 63, 482; s
of its treatment, i, 482;
treatment of, i, 483; in w
19; in contused and l
wounds, i, 36; urethral,
vesical, ii, 57; renal, ii,
gunshot wounds, ii, 57
tooth extraction, i, 673.
HÆMORRHAGIC DIATHESIS, i, 6
HÆMORRHOIDS, i, 801.
HÆMOSTATICS, i, 469; surgical
HÆMOTHORAX, ii, 45.
HAINSBY'S HARELIP TRUSS, i, 5
HAMMOND'S SPLINT, for fractur
i, 636.
HAND, amputation of, ii, 629;
tion of, ii, 369.
HANCOCK'S OPERATION on foot,
HANGING, ii, 49.
HARD CATARACT, i, 422.
HARELIP, i, 571; suture, i, 27
HEAD, injuries of, i, 249; gen
positions on, i, 253; treph
i, 283; conclusions on, i, 2
shot wounds of, ii, 585.

Headache after injury, i, 276.
Healing process, i, 17; in wounds, i, 14; in muscle, i, 18; in nerve, i, 18; defects in, i, 64.
Heart, wounds of, i, 466; gunshot wounds of, ii, 590.
Heat in inflammation, i, 69.
Hectic fever, i, 120.
Hereditary syphilis, i, 144.
Hernia, diagrams of, i, 732; abdominal, i, 734; anatomy of, i, 735; irreducible, i, 739; obstructed, i, 740; inflamed, i, 741; strangulated, i, 743; pathological changes in, i, 745; treatment of, i, 740; rupture of, i, 741; labial ii, 247; multiple, i, 759; displaced, i, 759; inguinal, i, 765; femoral, i, 773; obturator i, 776; umbilical, i, 778; other forms of, i, 781; congenital, i. 765; radical cure of, i, 769.
Hernia cerebri, i, 275; testis, ii, 225.
Hernial sac, i, 735; changes in, i, 735; absence of, i, 736; hydrocele of, i, 738; reduction of, i, 760; rupture of, i, 762.
Herniotomy, i, 751.
Herpes preputialis, ii, 192.
Hey's amputation, ii, 639.
Hilton's method of opening an abscess, i, 78.
Hip-joint, amputation at, ii, 631; after gunshot injuries, ii, 595; disease of, ii, 477; diagnosis of, ii, 481; pathology of, ii, 479, 506; treatment of, ii, 494; suppuration of, ii, 497; removal of necrosed bone from, ii, 506; excision of, ii, 508; division of neck of femur in disease of, ii, 499; dislocation of, ii, 373; old dislocations, ii, 381; congenital malformation of, ii, 394.
Hodgen's suspension splint, ii, 449.
Hodgkin's disease of glands, i, 241.
Holt's dilator, ii, 149.
Horny growth beneath nail, i, 232.
Horns, i, 189.
Hospital gangrene, i, 96.
Housemaid's knee, ii, 318.
Howard's "direct method" of artificial respiration, ii, 50.
Humerus, dislocation of, ii, 357; statistics of, ii, 357; reduction of, ii, 361; unreduced dislocations of, ii, 365, 425; fracture and dislocation of, ii, 365; compound dislocation of, ii, 365; fracture of, ii, 419; compound fracture of, ii, 433, impacted fracture of neck, ii, 419.
Hunterian chancre, ii, 192.
Hunter's operation for aneurism, i, 512.
Hydatids, i, 237; abdominal, ii, 729; diagnosis of, i, 729; of bone, ii, 565; of breast, ii, 277; of tongue, i, 591; of liver, i, 731; tapping, i, 731.
Hydrocele of hernial sac, i, 738; of cord and testes, ii, 198, 202; its pathology, ii, 199; congenital, ii, 200; encysted, ii, 206; radical cure of, ii, 206; on tapping, ii, 204; spontaneous disappearance of, ii, 209; ruptured, ii, 209; of neck, i, 185.
Hydro-nephrosis, ii, 61.
Hydrophobia, i, 127.
Hydro-sarcocele, ii, 221.
Hydro-thorax, ii, 45.
Hydrops, antri, i, 622; articuli, ii, 487.
Hygroma, i, 187.
Hymen, imperforate, ii, 249; rigid, 249.
Hypermetropia, i, 355; as cause of squint, i, 409.
Hypertrophy of extremities, ii, 327; of bone, ii, 566; of breast, ii, 268; of lips, i, 578; of tongue, i, 585; of veins i, 562.
Hypopyon, i, 373.
Hypospadias, ii, 184.
Hysteria, i, 305.
Hysterical retention of urine, ii, 176.
Hysterectomy, ii, 301.

Ice in hernia, i, 740.
Ice poultice, i, 201.
Ichthyosis linguæ, i, 588.
Ileum, rupture of, i, 688.
Iliac arteries, ligature of, i, 547.
Ilio-femoral triangle, ii, 442.
Ilio-sciatic dislocations of hip, ii, 375.
Ilium, fracture of, ii, 435.
Immediate union, i, 14.
Immobility in treatment of wounds, i, 30.

IMMOVABLE APPARATUS in fracture, ii, 406.
IMPACTED FRACTURE, ii, 398; of humerus, ii, 419; of radius, ii, 426; of neck of thigh-bone, ii, 438; of shaft of thigh-bone, ii, 447; of teeth, i, 652.
IMPACTION OF FÆCES, i, 713.
IMPERFORATE ANUS, i, 786; hymen, ii, 249.
IMPERMEABLE STRICTURE, ii, 142.
IMPOTENCE, ii, 243.
INCARCERATED HERNIA, i, 740.
INCISED WOUNDS, i, 10; bleeding in, i, 11; pain in, i, 11; local effects of, i, 11.
INCISION of membrana tympani, i, 457.
INCOMPLETE FRACTURE, ii, 397.
INCONTINENCE OF URINE, ii, 85.
INDIRECT OPHTHALMOSCOPIC EXAMINATION, i, 350.
INDOLENT SORES, i, 85.
INFANTILE, HERNIA, i, 766; hydrocele, ii, 200; paralysis, ii, 311; syphilis, i, 144.
INFLAMMATION, i, 69; as a cause of non-repair, i, 21; absorbent, i, 238; asthenic, i, 69; phenomena of, i, 69; increase of temperature in, i, 71; local effects of, i, 72.
INFLAMMATORY FEVER, i, 70.
INFLATION OF TYMPANUM, i, 444.
INGROWN TOE-NAIL, i, 229.
INGUINAL HERNIA, i, 765; direct and oblique, i, 765; diagnosis of, i, 767.
INHALER, CHLOROFORM, ii, 604-5.
INNOMINATE ARTERY, ligature of, i, 533.
INOCULATION, SYPHILITIC, i, 149; vaccino-syphilitic, i, 150.
INSANITY after head injury, i, 266.
INSECT STINGS, i, 124.
INTENTION, union by first, i, 14; by second, i, 16.
INTERARTICULAR CARTILAGES OF KNEE, subluxation of, ii, 384.
INTERNAL EAR, diseases of, i, 464.
INTERRUPTED SUTURE, i, 26.
INTERSTITIAL KERATITIS, i, 371.
INTESTINAL OBSTRUCTION, i, 707; diagnosis of, i, 707; causes of, i, 708; acute, i, 709; chronic, i, 712; from contractions, i, 713; from stricture, i, 713, 748; following hernia, i, 742.
INTESTINES, rupture of, i, 687; prot sion of, i, 696; obstruction of, 707; on tapping, i, 727; gunsh wounds of, ii, 590.
INTRA-CAPSULAR FRACTURE OF FEM ii, 438.
INTRA-CRANIAL SUPPURATION, i, 27
INTRA-PARIETAL SAC IN HERNIA, i, 7
INTRA-UTERINE FRACTURE, ii, 397.
INTUSSUSCEPTION, i, 716; operative terference in, i, 717.
INVERSION OF BODY in foreign bod air-passages, ii, 25.
IRIDECTOMY, i, 416; in glaucoma 389.
IRIDO-CHOROIDITIS, i, 383.
IRIDOTOMY, i, 420.
IRIS, congenital anomalies of, i, 3 inflammation of, i, 380; wou of, i, 383; coloboma of, i, 379.
IRITIS, i, 380.
IRREDUCIBLE HERNIA, i, 739.
IRRIGATION OF WOUNDS, i, 23, 47.
IRRITABLE, BLADDER, ii, 67; in wo ii, 257; mamma, ii, 262; ulce 83.
ISCHIATIC HERNIA, i, 781.
ISCHIO-RECTAL ABSCESS, i, 797.

JAW, deformities of, i, 631; frac of, i, 633; treatment of, i, 6 dislocation of, i, 631; necrosi i, 617; excision of, i, 626; tum of, i, 621, 624; closure o 630.
JEJUNUM, rupture of, i, 688.
JOINT AFFECTIONS after wounds nerves, i, 341.
JOINT DISEASE AND NERVOUS AF TIONS, ii, 532.
JOINTS, contusions of, ii, 346; compo fracture into, ii, 405; disloca of, ii, 349; diseases of, ii, 4 symptoms of, ii, 476; patho of, ii, 470; treatment of, ii, 4 amputation and excision of, ii, 5 false, ii, 413; wounds of, ii, 3 neuralgia of, i, 306; sprains o 346; anchylosis of, ii, 485, 504; loose cartilages in, ii, 5 acute suppuration round, ii, 5 necrosis of, ii, 480, 510, 519, 5
JUGULAR VEIN, wounds of, i, 556; o ing, i, 569.

KELOID, i, 211; of ear, i, 446.
KELOTOMY, i, 751.
KERATITIS, i, 371.
KEY'S LITHOTOMY, ii, 125.
KIDNEYS, injuries of, i, 690; ii, 56; tapping, ii, 61; stone in, ii, 59; malformations of, ii, 52; abscess in, ii, 62; operations on, ii, 60.
KNEE, amputation at, ii, 635; statistics of, ii, 513; anchylosis of, ii, 504; diseases of, ii, 486; treatment of, ii, 501; on tapping, ii, 501; mortality of amputation at, ii, 635; dislocation of, ii, 383; wounds of, ii, 348; suppuration of, ii, 510; excision of, ii, 513; operation of, ii, 515.
KNOCK-KNEE, ii, 341; Ogston's operation for, ii, 342; Macewen's, ii, 342.
KNOT, REEF, i, 476; granny, i, 476.

LABIA, adhesion of, ii, 247; tumours of, ii, 248; hypertrophy of, ii, 248.
LABYRINTH, affections of, i, 464.
LACERATED WOUNDS, i, 35.
LACHRYMAL APPARATUS, disease of, i, 404.
LACHRYMAL SAC, washing out, i, 407; obliteration of, i, 407.
LAMELLAR CATARACT, i, 422.
LAPAROTOMY, i, 718.
LARYNGITIS, ii, 30.
LARYNGOSCOPY, ii, 28.
LARYNGOTOMY, ii, 32.
LARYNX, disease of, ii, 28; requiring tracheotomy, ii, 28; excision of, ii, 32; foreign bodies in, ii, 22; wounds of, ii, 18; tumours of, ii, 31; syphilitic disease of, i, 143; ii, 30; scalds of, ii, 27; fracture of, ii, 18.
LATERAL CURVATURE of spine, i, 329.
LEECH, ARTIFICIAL, i, 398.
LEG, amputation of, ii, 622; fracture of bones of, ii, 458; statistics of, ii, 458; compound, of, ii, 464.
LEITER'S METALLIC COIL, i, 48.
LEMBERT'S SUTURE, i, 698.
LENS, affections of, i, 377; wounds of, i, 378; dislocation of, i, 378; diseases of, i, 377.
LEUCOCYTES, i, 11, 73.
LEUCORRHŒA, ii, 187.
LIGATURE, the action of, on artery, i, 472; of catgut, i, 472.
LIGATURE OF ARTERIES, i, 477; rules to be observed in, i, 529; mode of applying, i, 477; carbolized catgut in, i, 472; in aneurism, i, 511; of abdominal aorta, i, 532; of innominate, i, 533; of carotids, i, 535; of lingual, facial, i, 538; of arteries of upper extremity, i, 539; of iliac arteries, i, 547; of arteries of lower extremity, i, 547.
LIGHTNING, accidents from, i, 208.
LIME IN EYES, i, 369.
LINEAR EXTRACTION OF CATARACT, i, 426.
LINGUAL ARTERY, ligature of, i, 538; in cancer of tongue, i, 602.
LIP, congenital fissures of, i, 570; cancer of, i, 576; chancre of, i, 578; cysts of, i, 579; tumours of, 578; nævus of, i, 579; wounds of, i, 570; restoration of, i, 577; hare, i, 571; phlegmonous inflammation of, i, 579.
LIPOMA, i, 160; of conjunctiva, i, 408; of nose, ii, 5; of palm of hand, ii, 326.
LISFRANC'S AMPUTATION, ii, 639.
LISTERIAN method of dressing wounds, i, 54.
LITHIC ACID deposits, ii, 98; calculus, ii, 103.
LITHONTRIPTICS, ii, 112.
LITHOTOMY, ii, 123; when to be selected, ii, 123; causes of death after, ii, 137; sources of difficulty in, ii, 132; Key's operation, ii, 125; median, ii, 134; bilateral ii, 135; Buchanan's, ii, 135; recto-vesical, ii, 135; high operation, ii, 136; in female, ii, 137.
LITHOTOMY AND LITHOTRITY compared, ii, 113.
LITHOTRITY, ii, 115; when to be selected, ii, 113; perineal, ii, 134.
LITTRE'S OPERATION, i, 789.
LIVER, hydatids in, i, 731; ruptured, i, 686.
LLOYD'S (JORDAN) method of controlling hæmorrhage, ii, 663.
LOCAL ANÆSTHETICS, ii, 608.

Locked jaw, i, 293.
Locomotor ataxy, ii, 311.
Lodgment of balls, ii, 577.
Loose, cartilages, ii, 525; bodies in bursæ, ii, 320
Lordosis, i, 330; in malformation of hip, ii, 394; in hip disease, ii, 484; in rickets, ii, 569.
Lower jaw, removal of, i, 629; tumours of, i, 627.
Lumbar, abscess, i, 333; colotomy, i, 723.
Lunatics, fractures in, ii, 399; fractured ribs in, ii, 38.
Lungs, condition of, in apnœa, ii, 48; after drowning, ii, 48; laceration of, ii, 44; wounds of, ii, 39; hernia of, ii, 43.
Lupus, i, 89; of nose, ii, 5.
Lymphatics, affections of, i, 238; wounds of, i, 238.
Lymphoma, i, 195, 241.
Lyssi in hydrophobia, i, 130.

Macewen's operation for knock-knee, ii, 342.
Macintyre's splint, ii, 462.
Macroglossia, i, 585
Malformations, ii, 327; of anus, i, 786; of ear, i, 443; of genitals, ii, 182; of hip, ii, 394; of kidney, ii, 66; of feet, ii, 328.
Malignant pustule, i, 134; tumours, i, 171, 198.
Mamma, diseases of, ii, 258; excision of, ii, 280.
Manipulation, treatment of aneurism by, i, 515; reduction of dislocation of humerus by, ii, 361; of hip, ii, 379.
Marriage after syphilis, i, 149.
Masse, 'reduction,' en, i, 760.
Meatus, external, affections of, i, 447.
Median lithotomy, ii, 134.
Medio-tarsal, disease, ii, 489.
Medullary cancer, i, 174.
Meibomian glands, obstruction of, i, 363.
Melanosis, i, 169; of eyeball, i, 441;
Membrana tympani, injury to, i, 455; examination of, i, 456; perforation of, i, 457.
Meningeal artery, rupture of, i, 267.
Meningocele, i, 289.
Metatarsal bones, amputati through, ii, 639.
Microscopical anatomy of tumou i, 190.
Milk cysts, ii, 275.
Mixed calculus, ii, 102.
Moles, i, 227.
Mollities ossium, ii, 567.
Molluscous tumours of meatus, 452.
Moluscum fibrosum, i, 162.
Mortification, i, 91.
Mosquito bites, i, 125.
Mucous cysts, i, 187; of lips, i, 5 of tongue, i, 187.
Mulberry calculus, ii, 103.
Multiple hernlæ, i, 759.
Mumps, i, 583; orchitis in, ii, 218.
Muscles, injuries of, ii, 304; tumo of, ii, 313; vascular tumours ii, 314; rupture of, ii, 304; c pound laceration of, ii, 305; location of, ii, 306; degenera of, ii, 312; of pectoral, ii, inflammation of, ii, 309; of ste mastoid, ii, 309; division of, 325; atrophy of, ii, 311; r atrophy of, ii, 344; ossification ii, 314; hydatids in, ii, 313; chinæ in, ii, 313.
Mycetoma, i, 225.
Myeloid tumour, i, 168; ii, 560.
Myoma, i, 162, 197.
Myopia, i, 356.
Myxoma, i, 170, 197.

Nævus, i, 527; degeneration of, i, 5 587; of scalp, i, 289.
Nails, affections of, i, 229, 232.
Nasal douche, i, 463; ii, 3.
Nasal duct probing, i, 406.
Naso-pharyngeal polypus, ii, 10.
Neck of femur, fracture of, ii, 4 of humerus, fracture of, ii, 4 of scapula, fracture of, ii, 418.
Necrosis, ii, 546; operation for, 550; of jaws, i, 617; of stum ii, 648; phosphorus, i, 618; bones of skull, i, 291; arrest growth in bone after, ii, 551.
Needles, acupressure, i, 478; an rism, i, 531; nævus, i, 529; late, i, 698.

Nélaton's probe, ii, 583; test line for dislocation of hip, ii, 378.
Nephrectomy, ii, 65.
Nephritis, ii, 53.
Nephro-lithotomy, ii, 62.
Nephrorraphy, ii, 66.
Nephrotomy, ii, 62.
Nerves, influence of, in repair, i, 15; repair of, i, 18; injuries and disease of, i, 340; wounds of, i, 340; in head injuries, i, 265.
Nerve stretching, i, 344.
Neuralgia, i, 342, 656.
Neuritis, optic, i, 394.
Neuroma, i, 343.
Nipples, sore, ii, 258; chronic eczema of, ii, 279; retracted nipple, ii, 278.
Nitrous oxide, inhalation of, ii, 600.
Nodes, ii, 545.
Noma, ii, 247.
Nose, affections of, ii, 1; bleeding from, ii, 3; dislocation of cartilages of, ii, 2; foreign bodies in, ii, 7; formation of new, ii, 16; fracture of, ii, 1; obstructions of, ii, 7; plugging the, ii, 4; polypus of, ii, 8; washing out, ii, 3; wounds of, ii, 1.
Nuclear cataract, i, 422.
Nystagmus, i, 370.

Oblique inguinal hernia, i, 765.
Obstructed hernia, i, 740.
Obstruction of intestine, i, 707.
Obturator hernia, i, 776.
Obturator foramen, hernia into, i, 776; dislocation into, ii, 376.
Occipital artery, ligature of, 539.
Occluded ears, i, 443.
Occlusion, treatment of wounds by, i, 42.
Odontalgia, i, 655.
Odontoid process, displacement of, i, 339.
Odontomes, i, 620, 640.
Œdema glottidis, ii, 27.
Œsophageal forceps, i, 679; obstruction, i, 676.
Œsophagotomy, i, 681.
Œsophagus, foreign bodies in, i, 679; stricture of, i, 676; cancer of, i, 676.
Ogston's operation for knock-knee, ii, 342.
Oil cysts, i, 189.
Olecranon process, fracture of, ii, 431; bursa over, ii, 319.
Omental sac in hernia, i, 736.
Omental hernia, strangulated, ii, 745, 757.
Omentum, protrusion of, i, 696; adhesions of, in ovarian disease, ii, 296.
Onychia, i, 229; maligna, i, 230.
Open treatment of wounds, i, 44.
Operative interference in joint disease, ii, 505.
Ophthalmia, varieties of, i, 365; sympathetic, i, 385.
Ophthalmitis, i, 442.
Ophthalmoscope, examination by, i, 348.
Opisthotonos, i, 295.
Optic disc, anomalies of, i, 353.
Optic nerve, atrophy of, i, 395.
Optic neuritis, i, 394.
Orbit, affections of, i, 433; inflammation within, i, 434; tumours of, i, 438; hæmorrhage into, i, 435.
Orchitis, ii, 217; chronic, ii, 219; gouty, ii, 220; syphilitic, ii, 221; tubercular, ii, 223.
Oriental sore, i, 224.
Orthopædic surgery, ii, 327.
Osteitis deformans, ii, 572.
Osteo-arthritis, ii, 530.
Osteo-chondroma, ii, 560.
Osteo-malacia, ii, 567.
Osteo-myelitis, ii, 540; after amputation, ii, 648; after gunshot injuries, ii, 594.
Osteo-sarcoma, ii, 559.
Osteoid cancer, ii, 560.
Osteotomy, ii, 597; for badly-united fracture, ii, 414; in hip-joint disease, ii, 499; in deformity from rickets, ii, 571; in knock-knee, ii, 342.
Ostitis, ii, 537; of cranium, i, 291.
Otitis, i, 453; media, i, 463.
Ovarian cysts, suppurating, treatment of, ii, 300.
Ovarian dropsy, ii, 282; diagnosis of, ii, 284; tapping, diagnostic value of, ii, 287; pathology of, ii, 282; statistics of, ii, 283; tapping in, ii, 289; treatment of, ii, 289

Ovariotomy, selection of cases, ii, 290; operation, ii, 290; adhesions in, ii, 295; treatment of pedicle, ii, 297; on sponging out pelvis, ii, 298; treatment of wound, ii, 298; after-treatment, ii, 299.
Oxalate of lime as gravel, ii, 97; as calculus, ii, 104.
Ozæna, ii, 12.

Pain in inflammation, i, 69; in wounds, i, 11, 63.
Painful subcutaneous tumour, i, 345.
Paget's disease of nipple, ii, 279.
Palate, cleft, i, 606; tumours of, i, 612; wounds of, i, 611; ulcerations of, i, 612.
Palmar arch, wounds of, i, 547.
Pannus, i, 368.
Papillary tumours, i, 166; of rectum, i, 811.
Paracentesis abdominis, i, 501; pericardii, i, 466; thoracis, ii, 45; of joints, ii, 501; in ovarian dropsy, ii, 289; of cornea, i, 413; of kidney, ii, 61.
Paralysis, result of concussion, i, 272; spinal, i, 313; infantile, ii, 311; of bladder, ii, 83, 169.
Paraphimosis, ii, 179.
Parasites, i, 335.
Parasitic hæmaturia, ii, 57.
Parotid, inflammation of, i, 583; tumour of, i, 583.
Patella, dislocation of, ii, 382; fracture of, ii, 454; compound of, ii, 457; enlarged bursa over, ii, 319.
Pathological tubercle, i, 124.
Pectoral muscle, rupture of, ii, 37.
Pedicle in ovariotomy, treatment of, ii, 297.
Pelvic joints, diseases of, ii, 490.
Pelvis, fracture of, ii, 436; urethral laceration in, ii, 165, 436; obstructed iliac artery in, ii, 437.
Penetrating wounds of abdomen, i, 695; of chest, ii, 42; of cranium, i, 257, 274.
Penis, amputation of, ii, 186; malformations of, ii, 182; injuries of, ii, 181; cancer of, ii, 180; to fasten catheter in, ii, 148; warts on, ii, 180.
Perforating ulcer of foot, i, 22
of palate, i, 611.
Perforating tumours of skull, 289.
Pericardium, wounds of, i, 466.
Perinæum, rupture of female, ii, 2
operation for, ii, 250.
Perineal abscess, ii, 158.
Perineal, hernia, i, 781; fistula 160; section, ii, 155.
Perinephritis, ii, 56.
Periosteal exostosis, ii, 556; cer, ii, 561.
Periosteal flaps in amputation 619.
Periosteum, acute inflammation of 540; chronic, ii, 544.
Periprostatic abscess, ii, 88.
Peritoneum, inflammation of, i, 6 wounds of, i, 695.
Peroneal tendons, dislocation of, 306.
Phagedæna, i, 87; venereal, ii, 1
Phalangeal joints, diseases of, 493; dislocations of, ii, 372; f ture of, ii, 434.
Pharyngeal abscess, i, 333, 674; 30; tumours, ii, 30.
Pharynx, affections of, i, 674; for bodies in, i, 678; wounds of 678; tumours of, i, 674; ii, 1
Phimosis, ii, 176; with chancre, ii,
Phlebitis, i, 557; pyæmia and, i,
Phlebolithes, i, 565.
Phlegmasia dolens, i, 557.
Phlegmonous erysipelas, i, 102.
Phosphatic deposits, ii, 98; calcu ii, 106.
Phosphorus disease of jaws, i, 61
Phrenic hernia, i, 782.
Phthiriasis, i, 362.
Pigeon-breast, ii, 45.
Piles, i, 801.
Pinguiculæ, i, 408.
Pirogoff's amputation, ii, 6 stump after, ii, 645.
Pituitary membrane, thickening ii, 11.
Pivoting teeth, i, 664.
Plaster-of-Paris splints, ii, 406.
Plugging nostrils, ii, 4.
Pneumatic occlusion of wounds, 51.
Pneumocele, ii, 43.

PNEUMOTHORAX, ii, 45.
POISONED WOUNDS, i, 122.
POLITZER'S METHOD of inflating tympanum, i, 444.
POLYPUS OF ANTRUM, i, 624; of bladder, ii, 75; of ear, i, 455; of nose, ii, 8; of palate, i, 613; of vagina, ii, 250; of rectum, i, 810.
POPLITEAL ARTERY, ligature of, i, 552.
POSITION OF LOWER EXTREMITY in hip disease, ii, 482.
POTT'S FRACTURE, ii, 385.
POULTICE, ICE, i, 201.
PREPUCE, operations on, ii, 177; tumour of, ii, 181.
PRESBYOPIA, i, 377.
PRESSURE in the treatment of wounds, i, 301; to stop bleeding, i, 475; in cure of aneurism, i, 502.
PRIMARY OR QUICK UNION, i, 14; how to help it, i, 25.
PROBANG, i, 681.
PROJECTILES, wounds caused by, ii, 575.
PROLAPSUS OF RECTUM, i, 808.
PROPTOSIS OCULI, i, 243, 433.
PROSTATE GLAND, affections of, ii, 86; retention in, ii, 169; inflammation and suppuration of, ii, 87; hypertrophy of, ii, 88; calculi of, ii, 92; cancer of, ii, 94.
PROTECTION OF WOUNDS, i, 32.
PRURITUS ANI, i, 812.
PSOAS ABSCESS, i, 333.
PSORIASIS OF NAILS, i, 232.
PSEUDO-HYPERTROPHIC PARALYSIS, ii, 312.
PTERYGIUM, i, 375, 407.
PTOSIS, i, 404.
PUBES, dislocation of hip on, ii, 377.
PUBIC SYMPHYSIS, disease of, ii, 490.
PULLEYS in dislocation, ii, 331.
PULMONARY EMBOLISM, i, 491.
PULPY DEGENERATION of synovial membrane, ii, 470.
PULSATILE BONE TUMOURS, ii, 565.
PUNCTA LACRYMALIA, obstruction of, i, 404.
PUNCTURE OF BLADDER from rectum, ii, 172.
PUNCTURED WOUNDS, i, 38.
PUPIL, ARTIFICIAL, i, 419.
PURULENT OPHTHALMIA, i, 368; catarrh of ear, i, 459.
PUS, i, 73; absorption of, i, 76.
PUSTULE, malignant, i, 134.
PUZZLE TOY, value of, in dislocations, ii, 371.
PYÆMIA, i, 108; analyses of cases of, i, 114; post-mortem appearances in, i, 112; not hospital disease, i, 118; arterial, i, 115.
PYELITIS, ii, 53.
PYLORUS, excision of, i, 727.

QUILLED SUTURE, i, 28.
QUINSY, i, 613.

RABIES, i, 127.
RACHITIC affections of bones, ii, 569.
RADIAL ARTERY, ligature of, i, 546.
RADICAL CURE of hernia, i, 769; of hydrocele, ii, 206.
RADICULAR ODONTOMES, i, 642.
RADIO-ULNAR JOINT, disease of, ii, 493.
RADIUS, dislocations of, ii, 370; fractures of, ii, 431; compound, of, ii, 433.
RANULA, i, 581.
RATTLESNAKE, bites of, i, 125.
REACTION AFTER COLLAPSE, i, 12.
RECTAL ALIMENTATION, i, 821.
RECTAL DILATOR, ii, 78.
RECTANGULAR STAFF in lithotomy, ii, 135.
RECTO-VAGINAL FISTULA, ii, 253.
RECTOTOMY, LINEAR, i, 818.
RECTUM, affections of, i, 792; how to examine patient in, i, 793; injuries of, i, 790; rupture of, i, 791; prolapse of, i, 808; stricture of, i, 812, 815; excision of, i, 819; foreign bodies in, i, 792; malformations of, i, 786; painful ulcer of, i, 794; abscess of, i, 797; polypus of, i, 810; dilatation of, i, 820.
RECURRENT GROWTHS, i, 167.
REDNESS IN INFLAMMATION, i, 69.
REDUCTION OF DISLOCATIONS, ii, 351; of hernia, i, 748.
REFRACTION, i, 354.
REFRACTURE OF BONE, ii, 414.
REGENERATION OF NERVE, i, 19.
RELAXED UVULA, i, 613.
RENAL SURGERY, ii, 61.

Renal calculus, ii, 59; removal of, ii, 62; hæmaturia, ii, 56.
Repair of wounds, i, 14; causes of failure in, i, 19; repair of subcutaneous wounds, i, 59; of wounded arteries, i, 469; of fractures, ii, 410.
Reporting cases, headings for, i, 7.
Resection of joints, ii, 505; of false joints, ii, 413.
Resolution of inflammation, i, 72.
Respiration, artificial, ii, 49.
Rest in treatment of aneurism, i, 497; in ununited fracture, ii, 412.
Retained testis, ii, 237.
Retention of urine, ii, 167-170; hysterical, ii, 83; from adherent prepuce, ii, 170; from cicatricial stricture, ii, 170.
Retina, hyperæmia of, i, 390; atrophy of, i, 393; embolism of, i, 393; displacement of, i, 394.
Retinitis, i, 390.
Retraction of nipple, ii, 278.
Rheumatic arthritis, ii, 531; iritis, i, 380.
Rheumatism, gonorrhœal, ii, 190.
Rhinoplasty, ii, 16.
Rhinoscopy, ii, 6.
Ribs, fracture of, ii, 38; dislocation of, ii, 42.
Richardson's spray producer, ii, 608.
Rickets, ii, 569; acute, ii, 571; operative treatment in, ii, 571.
Rider's bone, ii, 315.
Rifle-ball wounds, ii, 576.
Rigg's disease, i, 667.
Rodent ulcer, i, 177.
Roussel's method of transfusion, i, 484.
Roux's amputation, ii, 644.
Rudimentary fingers and toes, ii, 327.
Rupia, syphilitic, i, 137.
Rupture, abdominal, i, 734; of abdominal viscera, i, 683; of aneurism, i, 518; of artery, i, 670; of bladder, i, 691; of eyeball, i, 431; of muscle, ii, 304; of rectum, i, 791; of urethra, ii, 165.

Sac, aneurismal, i, 493; suppuration of, i, 514; hernial, i, 735; omental, i, 736; kelotomy external to, i, 752.
Sacculated bladder, ii, 70.
Sacral tumours, i, 311.
Sacro-coccygeal joint, disease of, 490.
Sacro-iliac joint disease, ii, 490.
Salivary calculus, i, 582, 670; tula, i, 582.
Salter's swing, ii, 462.
Sarcoma, i, 167; melanotic, i, 169, 1
Sayre's jacket, i, 336.
Scab, union under, i, 17.
Scalds, i, 203; of the glottis, ii, 27
Scalp, affections of, i, 288; contus of, i, 250; wounds of, i, 251; s ceous cysts of, i, 188.
Scapula, dislocation of, ii, 356; f ture of, ii, 417; of neck of, ii,
Sciatic notch, dislocation of hip i ii, 375; hernia through, i, 781
Scirrhus, i, 173.
Scissors for skin grafting, i, 213.
Sclerosis of bone, ii, 539.
Sclerotic, inflamed, i, 376; inju of, i, 377.
Sclerotomy, i, 416.
Scorbutic ulcers, i, 88.
Scoop extraction, i, 428.
Scrofula, i, 6.
Scrotal tumours, diagnosis of, ii,
Scrotum, affections of, ii, 240; can of, ii, 242; injuries of, ii, 2 tumours of, ii, 241; elephas ii, 241.
Scurvy, i, 88.
Sebaceous cysts, i, 188; on head 189; fungating, i, 184; subling i, 581.
Second intention, healing by, i, 1
Secondary adhesion, i, 17; tr ment for, i, 41.
Semilunar cartilages of knee, s luxation of, ii, 384.
Seminal duct, inflammation of, 213; obstruction of, ii, 215.
Senile, cataract, i, 422; gangren 93; amputation in, i, 96.
Separation of epiphysis of fem ii, 384, 420, 446; of humerus, 369; of clavicle, ii, 356; of radi ii, 426.
Septicæmia, i, 108.
Septum of nose, malformations of, 10; injuries of, ii, 2; diseases ii, 10.

Sequestrum, removal of, ii, 550.
Sero-cystic disease of breast, ii, 273; of testicle, ii, 227.
Serous cysts, i, 185.
Serpents' bites, i, 125.
Serpiginous chancre, i, 148.
Seton in temple, i, 398.
Setting fractures, ii, 403.
Sexual hypochondriasis, ii, 243.
Sharp-hook extraction, i, 428.
Shock and collapse, i, 12, 301; operations during, i, 304; after gunshot injuries, ii, 579.
Shoulder, amputation at, ii, 625; dislocations at, ii, 357; excision of, ii, 519; diseases of, ii, 491, 518.
Sickness, chloroform, ii, 602.
Silkworm-gut for sutures, i, 29.
Sinus, i, 80.
Skin, formation of new, i, 15; transplantation of, i, 213.
Skull, contusion of, i, 252; fissure of, i, 254; fracture of, i, 254; incomplete fracture of, ii, 397; gunshot wounds of, ii, 585; perforating tumours of, i, 289.
Sloughing phagedæna, i, 87, 91; chancre, ii, 194.
Smith's (Nathan) wire splint, ii, 463.
Smith's (Thomas) gag for staphyloraphy, i, 607.
Snake bites, i, 125.
Snuffles, the, i, 145; ii, 7.
Soft, cataract, i, 421; chancre, ii, 192.
Softening of bone (mollities), ii, 567.
Solution of cataract, i, 423.
Solvents for stone, ii, 112.
Soot cancer, i, 176; ii, 242.
Sores, varieties of, i, 83; healing, i, 84; indolent, i, 85; inflamed, i, 86.
Sorethroat, syphilitic, i, 138; sloughing, i, 57.
Sounding for stone, ii, 109.
Spasmodic retention, ii, 167.
Spastic contractions, ii, 330.
Speculum, ear, i, 447; rectal, i, 795; laryngeal, ii, 28; urethral, female, ii, 257; vaginal, ii, 254.
Speir's artery constrictor, i, 480.
Spent balls, ii, 577.
Spermatic cord, hydrocele of, ii, 202; varicocele of, ii, 238.
Spermatocele, ii, 206.
Spermatorrhœa, ii, 245.
Spermatozoa, in encysted hydrocele, ii, 208.
Sphacelus, i, 91.
Sphincter ani, spasm of, i, 797.
Spica bandage, i, 758.
Spina bifida, i, 307; tumours simulating, i, 309.
Spinal, abscess, i, 333; instruments, i, 336.
Spinal, wounds of, cord, i, 327.
Spine, concussion of, i, 313; diseases of, i, 332; fracture and dislocation of, i, 320; curvature of, i, 329; railway injuries of, i, 316.
Spleen, rupture of, i, 687.
Splints in treatment of wounds, i, 30; ii, 403; immovable, ii, 406; for hip disease, ii, 497; for disease of knee, ii, 502; double thigh, ii, 445; for excision of elbow, ii, 522; for excision of knee, ii, 516.
Sponge, grafting, i, 217; how to prepare and clean, ii, 650.
Spontaneous cure of aneurism, i, 497.
Sprains of back, i, 328; of joints, ii, 346.
Squint, operations for, i, 410.
Staff lithotomy, ii, 125.
Staphyloma, i, 415; removal of, 375.
Staphyloraphy, i, 606.
Starched bandage, ii, 406.
Static or venous gangrene, i, 93.
Statistics of amputations, ii, 613; of subclavian aneurism, i, 541; of common carotid, i, 537; of torsion, i, 480, ii, 614; of necrosis of jaw, i, 617; of causes of intestinal obstruction, i, 708; of anal abscess, i, 797; of exostosis, ii, 557; of burns, i, 205; of cut throat, ii, 19; of artificial anus after hernia, i, 747; after colotomy, i, 726A; of fractured skull, i, 259; of fatal cases of pyæmia, i, 114; of pyæmia, i, 117; of spinal injuries, i, 323; of spina bifida, i, 309; of fractured ribs, ii, 38; of nephrectomy, ii, 66; of epididymitis, ii, 215; of stricture, ii, 142, 146; of tetanus, i, 294; of abdominal injuries, i, 685; of hernia, i, 738, 753; of stricture of rectum, i,

816; of stone, ii, 107; of lithotomy, ii, 124-5; of retention of urine, ii, 167, 170; of hydrocele, ii, 202; of cancer of testicles, ii, 231; of ovarian disease, ii, 283; of abscess of breast, ii, 259; of cancer of breast, ii, 272; of adenoma, ii, 266; of fracture, ii, 401, 438; of dislocations, ii, 349; of dislocation of humerus, ii, 357; of head of femur, ii, 373; of fracture of neck of femur, ii, 438, 441; of fracture of shaft, ii, 448; of fractures of leg, ii, 458; of excision of head of femur, ii, 507; of excision of knee, ii, 513; of wounded from gunshot injuries, ii, 574; of disease of knee, ii, 486; of hip disease, ii, 478; of excision of hip, ii, 507; of amputation at thigh, ii, 634; at knee-joint, ii, 635; of amputation at knee, ii, 513; of Syme's amputation, ii, 643.

STEATOMA, i, 160.

STERILITY, ii, 243.

STERNO-CLAVICULAR JOINT, diseases of, ii, 491; dislocation of, ii, 354.

STERNO-MASTOID MUSCLE, contraction of, ii, 345; induration of, ii, 309; division of, ii, 345.

STERNUM, dislocation and fracture of, ii, 42.

STINGS, insect, i, 124.

STOMACH, foreign bodies in, i, 702; rupture of, i, 687; opening the, i, 704.

STOMATITIS, i, 580.

STONE in bladder, ii, 101, 108; its frequency, ii, 107; in kidney, ii, 59; in urethra, ii, 141, 175; in woman, ii, 137.

STOPPING TEETH, i, 661.

STRABISMUS, i, 408; operation for, i, 410.

STRANGULATED HERNIA, i, 743; mechanism of, i, 743; omental, i, 745; treatment of, i, 748.

STRANGULATION, internal, i, 709; of ovarian tumour, ii, 300.

STRICTURE AND RETENTION, ii, 167.

STRICTURE of urethra, ii, 142; results of, ii, 146; inflammatory, ii, 168; spasmodic, ii, 167; its
tions, ii, 158; traumati
tricial, ii, 162; treatm
147; summary of, ii, 16
of death in, ii, 146, 16
testine after hernia, i,
œsophagus, i, 676; of
812, 815.

STROMEYER'S CUSHION, ii, 43

STUMPS, affections of, ii, 646
of, ii, 621; conical, ii, 6
over stumps, ii, 649; n
ii, 648; painful, ii, 647.

STYES, i, 363.

STYPTICS, i, 481.

SUBASTRAGALOID AMPUTATIO
dislocation, ii, 389.

SUBCLAVIAN ANEURISM, i, 53
ligature of, i, 541.

SUBCLAVICULAR DISLOCATIO
der, ii, 360.

SUBCORACOID DISLOCATION of
ii, 357.

SUBCUTANEOUS, CONTUSED w
36; wounds, i, 58; op
58; treatment of, i, 60
rhage, i, 471.

SUBCUTANEOUS LIGATURE, of
527.

SUBDIAPHRAGMATIC ABSCESS

SUBGLENOID DISLOCATION of
ii, 359.

SUBLINGUAL CYSTS, i, 581.

SUBMAMMARY ABSCESS, ii, 2

SUBPECTORAL ABSCESS, ii, 44

SUBSPINOUS DISLOCATION of
ii, 359.

SUCTION, removal of catar
429.

SULPHURIC ACID, treatment
of bone by, ii, 554.

SUPPLEMENTAL TEETH, i, 64

SUPPRESSION OF URINE, ii, 5

SUPPURATION, i, 73.

SUPRACONDYLOID AMPUTA
thigh, ii, 634.

SUPRAPUBIC PUNCTURE of b
175.

SURGICAL CASES, how to in
i, 7.

SUSPENSORY BANDAGE, ii, 2
gan's ii, 240.

SUTURES, materials for, i, 29
i, 29; hare-lip, i, 27; dee

continuous, i, 27; interrupted, i, 26; quilled, i, 28; twisted, i, 27; of intestine, i, 27, 698.
SWELLING IN INFLAMMATION, i, 69.
SYMBLEPHARON, i, 402.
SYME'S amputation of foot, ii, 643; operation for aneurism, i, 514; operation for stricture, ii, 152.
SYMPATHETIC OPHTHALMIA, i, 385.
SYMPHYSIS PUBIS, diseases of, ii, 490.
SYNCOPE, i, 474.
SYNOSTOSIS OF HIP, ii, 485.
SYNOVIAL CYSTS, ii, 324.
SYNOVIAL MEMBRANE, diseases of, ii, 470.
SYPHILIS, i, 135; acquired, i, 137; sorethroat in, i, 138; affections of tongue in, i, 139, 596; affections of bone in, i, 139; pathology of, i, 140, ii, 192; treatment of, i, 141; hereditary, i, 144; teeth in, i, 147; serpiginous ulceration in, i, 148; marriage after, i, 149; inoculation in, i, 149.
SYPHILITIC DISEASE of rectum, i, 813; of iris, i, 381; of testicle, ii, 221; of larynx, i, 143.
SYPHILITIC, SORES, i, 83, 89; teeth, i, 645.
SYPHILIZATION, i, 150.
SYRINGING EAR, i, 449.

TAGLIACOTIAN OPERATIONS, ii, 16.
TALIPES, different forms of, ii, 331; their treatment, ii, 334.
TAPPING abdomen, i, 728; ovarian cysts, ii, 289; hydrocele, ii, 204; intestines, i, 727; chest, ii, 48; hydatid, i, 731; knee, ii, 501.
TARSAL CARTILAGE, tumours of, i, 399.
TARSAL CYSTS, i, 399.
TARSUS, operations on, ii, 636; diseases of, ii, 489; dislocations of, ii, 389.
TAXIS, the, i, 749; where inadmissible, i, 750.
TEALE'S AMPUTATION, ii, 622; probe gorget, ii, 153.
TEAR PASSAGE, operations on, i, 405.
TEETH, cysts containing, i, 622, 643, 653; syphilitic, i, 147.
TEETH, diseases of, i, 654, 659; cutting of, i, 649; affections of pulp, i, 665; of alveolo-dental membrane, i, 666; local dental periostitis, i, 667; fracture of, i, 665; supernumerary, i, 644; supplemental, i, 644; malformed, i, 646; irregularity of, i, 649; impaction of, i, 652; absence of, i, 653; extraction of, i, 671.
TEMPERATURE in inflammation, i, 71; in traumatic fever, i, 13, 108; in spinal injury, i, 315.
TEMPERO-MAXILLARY articulation, diseases of, i, 630; dislocation of, i, 631.
TEMPORAL ARTERY, ligature of, i, 539.
TENDO ACHILLIS, division of, ii, 309, 336; rupture of, ii, 307.
TENDONS, inflammation of, ii, 309-317; rupture of, ii, 307; wounds of, ii, 308; tumours of, ii, 316; repair of, after division, ii, 333; dislocation of, ii, 306.
TENOTOMY, ii, 335; in contracted joints, ii, 343; in fracture, ii, 403, 453, 462.
TESTICLE, its development, ii, 213; mal-position of, ii, 237; disease of, ii, 212; inflammation of, ii, 212; acute, ii, 217; chronic, ii, 219; syphilitic, ii, 221; gouty, ii, 220; tubercular disease, ii, 223; hernia of, ii, 226; cystic disease of, ii, 227; cancer of, ii, 230; excision of, ii, 237; strapping, ii, 237.
TETANUS, i, 293; infantile, 293; pathology of, i, 296; statistics of, i, 294.
THECAL ABSCESS, ii, 317.
THERMOGRAPH of erysipelas, i, 100; traumatic fever, i, 110; enterotomy, i, 721.
THIGH, amputation of, ii, 634; statistics of, ii, 634; fracture of, ii, 438; compound, ii, 454.
THOMAS'S SPLINTS for knee, ii, 502; for hip, ii, 496.
THORAX, injuries of, ii, 37; tapping, ii, 45; abscesses about, ii, 44.
THROAT, wounds of, ii, 19.
THROMBOSIS, i, 557.
THUMB, dislocations of, ii, 371; compound fracture of, ii, 435; amputation of, ii, 629; excision of joints of, ii, 524.
THYROID, cysts of, i, 185, 245; diseases of, i, 243; extirpation of, i, 248.

THYROID FORAMEN, dislocation into, ii, 376.
TIBIA, dislocation of, ii, 383; fracture of, ii, 458; V-shaped fracture of, ii, 460; arrest of growth after, ii, 458.
TIBIAL ARTERY, ANTERIOR, ligature of, i, 554.
TIBIAL ARTERY, POSTERIOR, ligature of, i, 552.
TIC DOLOUREUX, i, 342.
TINEA TARSI, i, 363.
TOE-NAIL, ingrown, i, 229; horny, i, 232.
TOES, amputation of, ii, 646.
TONGUE, congenital affections of, i, 585, 588; diseases of, i, 585; hypertrophy of, i, 585; inflammation of, i, 591; extirpation of, i, 604; wounds of, i, 585; ulcers of, i, 593; cancers of, i, 599; ichthyosis of, i, 588.
TONGUE TIE, i, 584.
TONSIL, disease of, i, 613; cancer of, i, 616; excision of, i, 616.
TOOTH, development of, i, 638.
TOOTHACHE, i, 655.
TOOTH CYSTS, i, 622, 643, 653.
TOOTH TUMOURS, i, 624.
TOOTH WOUNDS, i, 40.
TORSION ON ARTERIES, effects of, i, 473; mode of doing it, i, 479; statistics of, i, 480; ii, 614.
TORTICOLLIS, ii, 345.
TOURNIQUET, i, 476.
TOWNE'S stereoscopic test for retina, i, 362.
TRACHEA, foreign bodies in, ii, 22; wounds of, ii, 19; subcutaneous division of, ii, 19.
TRACHEAL ASPIRATOR, ii, 35.
TRACHEOTOMY, ii, 33; its complications, ii, 35; for disease of larynx, ii, 28; for foreign bodies, ii, 24; tubes, ii, 34; in tetanus, i, 298.
TRANSFUSION, i, 484.
TRANSPLANTATION OF SKIN, i, 213.
TRAUMATIC, ANEURISM, i, 517; delirium, i, 298; fever, i, 13, 108, 110; gangrene, i, 92, 94; stricture, ii, 162.
TRENDELENBURG'S tracheal tampon, i, 613.
TREPHINING, SKULL, i, 283; spine, 327; long bones, ii, 543.
TRICHIASIS, i, 399.
TRICHINIASIS, ii, 313.
TRIPIER'S AMPUTATIONS of the fo ii, 641.
TRISMUS INFANTUM, i, 293.
TROCHANTER, fracture of epiphysis ii, 446.
TRUSSES, i, 782; for irreducible h nia, i, 739; to measure for 785.
TUBERCLE, i, 5; mucous, i, 139.
TUMOURS, i, 152; innocent, i, 1 semi-malignant, i, 167; cancer i, 171; sebaceous, of scalp, i, 1 follicular, i, 184; perforating skull, i, 289; congenital, of crum, i, 311; painful subc neous, i, 345; of jaws, i, 621; tic, i, 185; fatty, i, 160; fi mata, i, 161; myxoma, i, 1 fibrous, i, 163; cartilaginou 163; ii, 558; osseous, i, 165; m loid, i, 168; glandular or aden i, 165; papillary, i, 166; re rent, i, 167; sarcomata, i, 1 melanotic, i, 169; hard, i, 1 soft, i, 174; rodent ulcer, i, 1 colloid cancer, i, 178; villou 179; granulation, i, 184; pu tile, ii, 565; cancerous, i, 1 diagnosis of, i, 171; epithelio i, 176; osteoma, i, 193; sarco i, 196; myxoma, i, 197; adeno i, 194; carcinoma, i, 198; ly phoma, i, 195; colloid, i, 1 thyroidal, i, 243.
TUMOURS, microscopical anatomy i, 190.
TUMOURS OF BLADDER, ii, 74.
TUMOURS OF BONE, ii, 554; their d gnosis, ii, 563; their enucleati ii, 564; exostosis, ii, 555; ung i, 232; ii, 556; cartilaginous, 558; osteo-sarcoma and chond ma, ii, 559; myeloid, ii, 560; c cers of, ii, 560; epithelial, of, 563; pulsatile, ii, 565; hyda ii, 565.
TUNICA VAGINALIS, hydrocele of, 198.
TWISTED SUTURE, i, 27.
TYMPANUM, inflating, i, 444.

N, i, 82; of rectum, i, 794.
82.
CORNEA, i, 374.
cation of, ii, 365; fractures
431.
ERY, ligature of, i, 546.
VE, injuries to, i, 341.
HERNIA, i, 778.
, tumours of, i, 731.
COSTOSIS, i, 232; ii, 556.
WOUNDS, i, 14; of broken
ii, 410; of divided tendons,
, 333.
D DISLOCATIONS, ii, 351.
FRACTURES, ii, 412.
V, removal of, i, 626.
pen, i, 731.
deposits, ii, 97.
jjuries of, i, 690; stone in,

ruptured, ii, 162, 165; with
re of pelvis, ii, 436; obstruc-
f, ii, 141; stricture of, ii,
calculus in, ii, 141, 175; in-
ation of, ii, 186; affections
ale, ii, 257.
tapping in perinæum, ii,

OMY, internal, ii, 151; ex-
ii, 152.
abscess, ii, 158; fistula, ii,
deposits, ii, 96.
uminous, ii, 96; healthy, ii,
posits in, ii, 97; blood in,
76; incontinence of, ii, 85;
w of, ii, 86; retention of,
; suppression of, ii, 59; ex-
ation of, ii, 158.
tirpation of, ii, 301; prolapse
252.
ngation of, i, 613.

FRACTURE OF TIBIA, ii,

R's, instructions for, i, 151.
YPHILIS, i, 150.
oreign bodies in, ii, 247;
mations of, ii, 249; injuries
247.
ISTULÆ, operations for, ii,

YSTOCELE, &c., ii, 252; litho-
ii, 139.
333.

VALSALVA'S treatment of aneurism, i, 501.
VARICOCELE, ii, 238.
VARICOSE ANEURISM, i, 521; ulcer i, 87; veins, i, 563.
VARIX, i, 563; aneurismal, i, 520.
VASCULAR KERATITIS, i, 372.
VASCULAR PROTRUSION of eyeball, i, 245, 436.
VASCULAR TUMOUR, i, 527; of gums, i, 671.
VAULT OF SKULL, fracture of, i, 254.
VEINS, wounds of, i, 555; injection into, i, 484; injuries and diseases of, i, 555; operations on, i, 566; hæmorrhage from, i, 483; entrance of air into, i, 561; varicose, i, 563.
VELUM PALATI, wounds of, i, 611.
VENEREAL DISEASES, local, ii, 186.
VENESECTION, operation of, i, 568; in chest injuries, ii, 41; in head injuries, i, 278.
VENOUS or static gangrene, i, 93.
VENTRAL HERNIA, i, 781.
VERUCA, i, 226; necrogenica, i, 124.
VERTICAL EXTENSION in fracture of thigh, ii, 451.
VESICAL hæmorrhage, ii, 57.
VESICO-INTESTINAL FISTULA, i, 726A; ii, 84.
VESICO-PROSTATIC CALCULUS, ii, 92.
VESICO-VAGINAL FISTULA, ii, 253.
VIENNA PASTE, i, 182.
VILLOUS GROWTHS, i, 166; of bladder, ii, 74; of rectum, i, 811.
VISCERA, ABDOMINAL, protrusion of, i, 696; rupture of, i, 686; wounds of, i, 698.
VISION, FIELD OF, i, 360; anomalies of, i, 390.
VITREOUS HUMOUR, affections of, i, 386.
VOLVULUS, i, 709.
VULVA, INJURIES OF, ii, 246.
VULVITIS, ii, 247.

WARDROP'S OPERATION for aneurism, i, 512.
WARTS, i, 226; anal, i, 812; venereal, i, 226; ii, 180.
WATER DRESSING, i, 47.
WAX IN EAR, i, 449.
WEAK SORES, i, 85.
WEBBED FINGERS and toes, ii, 328.

WEIGHT, extension by, ii, 449, pressure by, i, 503.
WENS, i, 189.
WHEELHOUSE' OPERATION for stricture, ii, 153.
WINDPIPE, foreign bodies in, ii, 22.
WOMEN, surgical diseases of genitals in, ii, 246; stone in, ii, 137.
WOUNDS, i, 9; local effects of, i, 11; constitutional effects of, i, 12; adhesion in, primary i, 14; secondary, i, 17; alcoholic dressing of, i, 50; antiseptic irrigation of, i, 52; arrest of bleeding in, i, 19; arrow, i, 202; cicatrization of, i, 15; granulation of, i, 16; dressing of, i, 22; second dressing of, i, 33; complications of, i, 61; coaptation of, i, 26; contused i, 20, 35; incised, i, 10; treatment of, i, 22; lacerated, i, 20, 35; open, i, 37; treatment of, i, 37, 41; poisoned, i, 122; punctured, i, 38; subcutaneous, i, 58; tooth, i, 40; repair in, i, 14; by primary or secondary adhesion, 24; non repair in, i, 19; hæmorrhage in, i, 19; treatment of, i, 2 six cardinal points to be observ in, i, 25; special treatment of, i, 4 by occlusion, i, 42; open meth i, 44; by water dressing, i, dry dressing, i, 49; earth dressi i, 50; alcoholic dressing, i, 50; pneumatic occlusion, i, 51; a septic irrigation, i, 52; Lister method, i, 54; of scalp, i, 251; nerves, i, 340.
WRIST, amputation at, ii, 629; dication at, ii, 369; suppuration excision of, ii, 523; diseases of, 492.
WRITER'S CRAMP, ii, 313.
WRY-NECK, ii, 345.

XANTHELASMA OF LIDS, i, 399.
XANTHIC OXIDE CALCULUS, ii, 106.

ZINC, chloride of, paste, i, 182.

PRINTED BY J. E. ADLARD, BARTHOLOMEW CLOSE.

